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History and biology of the reassigned Ruvu Weaver *Ploceus holoxanthus*

H. Dieter Oschadleus, Staffan Andersson and Neil E. Baker

Summary

Ploceus holoxanthus was formally described by Karel Johan Gustav Hartlaub in 1891, based on specimens collected by Friedrich Bohndorff, from Mtoni on the Kingani (now Ruvu) River, Tanzania. Reichenow (1904, p 91) and Zedlitz (1916) synonymized this taxon with African Golden Weaver *P. subaureus*, although Shelley (1905) and Hartert (1907) had recognized it as a new species. Sclater (1930) and other subsequent authors simply considered *P. holoxanthus* as a synonym of African Golden Weaver, and eventually it was not even listed as a synonym. In recent years, birds resembling *P. holoxanthus* have been increasingly photographed. Thus, this taxon was included in a recent phylogeny of the Ploceidae, which recognized *P. holoxanthus* as a valid species. This paper reviews the history of this taxon, lists all specimens, published references and photographs, and measurements. The nest and eggs are described for the first time.

Keywords: *Ploceus holoxanthus, Ploceus subaureus*, Ruvu River, Mtoni, Bagamoyo, Zedlitz, Tanzania

Introduction

Ploceus holoxanthus (hereafter *holoxanthus*) has been recognized as a distinct species in a recent phylogenetic analysis (Fjeldså *et al.* 2020). This taxon was first described by Karel Johan Gustav Hartlaub, a German physician and ornithologist, based on specimens collected by Friedrich Bohndorff, a German explorer and ornithologist, from Mtoni on the Kingani (now Ruvu) River (6°28′45″ S, 38°49′56″ E), Tanzania (Hartlaub 1891, p 1–2). Although Shelley (1905) and Hartert (1907) had recognized it as a new species, Reichenow (1904, p 91) and Zedlitz (1916) synonymized this taxon with the African Golden Weaver *P. subaureus*. So did Sclater (1930) and other subsequent authors, and eventually *holoxanthus* was not even listed as a synonym. The African Golden Weaver has two distinctive subspecies, the nominate in southern Africa, and *P. subaureus aureoflavus* (hereafter *aureoflavus*) in eastern Africa; only the latter subspecies is relevant in this paper.

In recent years, birds resembling *holoxanthus* have been increasingly photographed. These observations highlighted the need to include this taxon in molecular phylogenetic analyses of the Ploceidae (Fjeldså *et al.* 2020), otherwise this taxon would probably have been overlooked. This paper reviews what is known about *holoxanthus* in the literature, and provides new breeding information based on field observations and photographs. In particular, we investigate the historical background and details of the collected specimens and how this led to the 'disappearance' of this taxon from the ornithological literature.

Methods

We searched for references to the taxon *holoxanthus* in published literature, using a bibliography of the Ploceidae family, numbering over 24000 references. We extracted photographs in the PHOWN (PHOtos of Weaver Nests, http://weavers.adu.org.za/phown.php) database, part of the Virtual Museum (http://vmus.adu.org.za) citizen science project at the University of Cape Town. Photographs also appear on some other websites.

Results and Discussion

1. Historical background

In the 1880s Friedrich Bohndorff (1848–1921) participated in expeditions to the African interior, where he collected insects and birds, including 30 bird types. Five avian taxa are named after him, including a weaver (subspecies)—the Village Weaver *P. cucullatus bohndorffi* (Reichenow 1887). In 1889, Bohndorff joined as a dragoman (i.e., interpreter and guide) of the Schutztruppe under Hermann von Wissmann (1853–1905) in German East Africa (now Tanzania), because of the Arab revolt of 1888–1890. In 1890, Bohndorff was assigned as deck officer on the Mtoni ferry to cross the Kingani River near Bagamoyo, before returning to Berlin in 1893 (Schweitzer 1898). Bohndorff was at Mtoni in January 1890 (R.J. Dowsett, pers. comm.) when he collected the types of the Ruvu Weaver, which were sent to Hartlaub together with the specimens from Emin Pascha (Hartlaub 1891, p 1).

Emin and Bohndorff

Stanley brought Emin to Bagamoyo where they arrived on 4 December 1889. Emin had an accident on the first night, and remained in hospital until late January 1890. He conducted some collecting around Bagamoyo while planning his return to Uganda, and finally left on 26 April 1890 (Schweitzer 1898). Emin wrote a letter to Hartlaub on 27 January 1890 from his hospital bed in Bagamoyo, mentioning the specimens to later be sent with his letter, from the German consulate in Zanzibar (Stuhlmann & Schubotz 1921, p 288). Although Emin did not mention Bohndorff's specimens in the letter, these were presumably added while a hired taxidermist helped Emin prepare the specimens.

The consignment of specimens that was sent to Germany included birds of three collections (Hartlaub 1891):

1. Specimens collected by Emin on the latter part of Stanley's expedition.
2. Eight species collected by Bohndorff, all labelled 'Mtoni', including *holoxanthus*, collected in January or March (see below); a date of January was given for one specimen (*Sternula novella* = *Sterna albifrons*).
3. 29 species collected by Emin around Bagamoyo, between February and April 1890; in three cases dates in February are provided (Hartlaub 1891). For only one species, *Pyromelana nigriventris* (= *Euplectes nigroventris*), did Emin collect one each at Mtoni and Bagamoyo, thus possibly meeting Bohndorff at Mtoni.

Emin's shipment to Hartlaub must have been finally boxed before Emin left Bagamoyo in late April 1890, and arrived at the British Museum in July 1890 (Anon. 1894). Hartlaub would have needed some time to work through the material and his paper describing the above specimens was published in April 1891.

Specimens

Hartlaub (1891) described the *holoxanthus* holotype (AMNH #724738, LeCroy 2014), without mentioning other specimens (Table 1). However, Bohndorff also collected a female (Hartert 1907, LeCroy 2014). Shelley (1905) mentioned two males and two females in the British Museum, all collected by Bohndorff at Mtoni. The specimens were at Tring until 1932 when Rothschild sold most of his skin collection to the American Museum of Natural History in New York (LeCroy 2014). LeCroy (2014) lists two specimens, suggesting that Shelley's (1905) additional specimens were lost, or are still in a museum somewhere, or were mis-identified (but this is less likely because of his detailed description). Many type specimens of names introduced by Hartlaub are in the Bremen Museum collection, but Sánchez Osés (2010, p 67) noted that no *holoxanthus* types were found there.

Table 1. List of specimens of the Ruvu Weaver *Ploceus holoxanthus* collected by Bohndorff at Mtoni, Tanzania.

Type/specimens	Sex	Source
1. AMNH 724738, holotype	male	LeCroy (2014), Hartlaub (1891)
2. AMNH	female	LeCroy (2014), Shelley (1905)
3. specimen (current location unknown)	male	Shelley (1905)
4. specimen (current location unknown)	female	Shelley (1905)

In his introduction, Hartlaub notes that Bohndorff's specimens were quite well prepared and provided with the necessary notes (Hartlaub 1891, p 1), and he also acknowledges the help and information provided by Anton Reichenow (Berlin), George Ernest Shelley, Henry Seebohm and Richard Bowdler Sharpe (Tring). Shelley and Sharpe briefly saw the *holoxanthus* specimen and were hesitant at the time of separating it from *aureoflavus*, while Reichenow agreed with Hartlaub (Hartlaub 1891, p 22).

Date of specimens

Shelley (1905) gives the collection date as March, while Hartert (1919), Turner & Baker (2011) and LeCroy (2014) give January, which is more likely from a historical point. However, it is possible that additional specimens (i.e., those that Shelley saw) were collected in March, and added to the consignment sent to Hartlaub.

2. Loss of a species, and re-instatement

Hartlaub (1891) described *holoxanthus* as a new species (Table 2), with which Reichenow (1894, 1897) initially concurred, but later he considered it as a synonym of *aureoflavus* (Reichenow 1904, p 91). Nevertheless, Shelley (1905), and initially Hartert (1907), considered *holoxanthus* as unique.

Table 2. List of all references mentioning Ruvu Weaver *Ploceus holoxanthus*, with annotations, listed chronologically. Taxon: sp = species (*holoxanthus* recognized at species level); syn = synonym (*holoxanthus* recognized as synonym); n/a = author lists *holoxanthus* without assigning taxonomic status.

Reference	Taxon	Notes (reference to *holoxanthus*)
Hartlaub (1891)	sp	Described new species; Reichenow saw the type and agreed with Hartlaub that it was new; Sharpe and Shelly saw it briefly and were hesitant to consider it separable [published April 1891]
Reichenow (1891b)	sp	Notification of recent publication - listed (in German, from meeting on 23 April 1891)
Anon. (1891)	sp	Notification of recent publication - listed (July 1891 issue of *Ibis*)
Reichenow (1894)	sp	Gave a brief summary of the species, distinguishing it from *P. aureoflavus*
Shelley (1896)	sp	List of African birds, including Ploceus *holoxanthus*
Reichenow (1897)	sp	List of East African birds, including Ploceus *holoxanthus*
Reichenow (1904), pp.91-92	syn	Now treated it as a synonym of *P. aureoflavus* [= *subaureus* - Reichenow appears to have had a single specimen that he looked at, and he considered that it was a mature phase of African Golden Weaver
Shelley (1905)	sp	Referred to Reichenow 1904 but nevertheless considered *holoxanthus* to be unique, apparently based on 4 specimens, 2 males and 2 females; first description of female; Shelley provided a plate of a male
Anon. (1905)	sp	Notification of recent publication—and the plates in Shelley (1905)
Hartert (1907)	sp	Also considered *holoxanthus* as distinct, based on plumage and measurements of 2 specimens, a male and a female
Sharpe (1909)	sp	List of species with range of each species (listed as *Sitagra holoxantha* from "Zanzibar")
Zedlitz (1916)	syn	Argued that Reichenow [1904] was correct; Zedlitz looked at a series of "golden weaver" specimens, mostly from the Berlin Museum, however, he did not see the *holoxanthus* types
Hartert (1919)	syn	Now agreed with Zedlitz (1916), as Hartert thought Zedlitz had studied a large series of *holoxanthus* specimens
Sclater (1930)	syn	Synonymy of African birds; *holoxanthus* listed as synonym of *aureoflavus*
Moreau & Moreau (1937)	n/a	Discussed golden weavers in Tanzania, considered some specimens to be *holoxanthus* (but should probably be *P. castaneiceps*)
Moreau (1962)	syn	Synonym of *P. subaureus aureoflavus*
Sánchez Osés (2010)	syn	No specimens found in Bremen Museum
Turner & Baker (2011)	n/a	Status of *P. bojeri*; refer to Moreau & Moreau's (1937) reference to *holoxanthus*
LeCroy (2014)	syn	Holotype details in AMNH; mentions female with no details
Mills & Leventis (2017)	sp	List of African birds; accepted as a separate species
Turner & Kennedy (2019)	sp	Brief note on the loss of *holoxanthus*, and a call for a full systematic review
Fjeldså *et al.* (2020)	sp	Genetic analysis, showing *holoxanthus* is a distinct species

In a discussion of the birds of southern Somalia, Zedlitz (1916) included two 'golden weaver' species, Golden Palm Weaver *P. bojeri* and *aureoflavus*, but also mentioned Taveta Golden Weaver *P. castaneiceps* and *holoxanthus*. While he gave new features to distinguish females of *P. bojeri* and *P. castaneiceps*, he did not recognize *holoxanthus* as separate from *aureoflavus*. He studied a long series of specimens in the Berlin Museum, and concluded that they were all *aureoflavus* [we agree], and therefore considered *holoxanthus* to be not valid [we disagree, see below].

In his discussion of types in the Tring Museum, Hartert (1919) synonymized *holoxanthus* with *aureoflavus*, simply based on Zedlitz (1916) and presumably without examining the *holoxanthus* specimens which were still at Tring. Sclater (1930) and other authors subsequently simply followed Zedlitz (1916) and Hartert (1919), and by 1932 the specimens had been sold to the AMNH.

Zedlitz's error

From the large series of *aureoflavus* specimens, Zedlitz singled out two that could be male *holoxanthus*, one from Mtiras village (collected by Fülleborn) and one from Msua (collected by Emin). He only noted these as potential '*holoxanthus*' because he thought the collecting sites were near Mtoni. The other specimens that Zedlitz mentioned, he and other authors never considered as *holoxanthus*, and their localities are also far from the known range of *holoxanthus*, and are not discussed further.

(1) Specimen from Mtiras (Mtira's or Kwa Mtira, Rovuma River at 11°33′S, 36°55′E). Zedlitz noted that the Mtiras specimen (collected in June; Reichenow 1904, p 92) was the second largest of his series (of *aureoflavus*) at 78 mm, i.e., being too large to be *holoxanthus*. Furthermore, Mtiras is on the Rovuma River on the Tanzanian–Mozambican border (Shelley 1905, p 478), some 475 km from Mtoni, contra Zedlitz. Shelley (1905, p 478) listed Fülleborn's Mtiras specimen under *aureoflavus* (*aureoflavus*), although he did mention the possibility that it could belong to *holoxanthus* (p 480). Unfortunately, the eye colour of this specimen is not documented, but due to the size of the bird we consider it to be *aureoflavus*.

(2) Specimen from Msua (near Bagamoyo at 6°46′S, 38°28′E; Mssua in Reichenow 1891a). Emin left Bagamoyo in April 1890 with an expedition to return to Uganda. On 2–3 May, the first collecting site was Msua, some 60 km SW of Bagamoyo (Reichenow 1891a, 1894). Here, Emin collected a bird that Reichenow listed as *aureoflavus*, with a short description: "Length. 153 mm. Eye orange yellow; beak black; feet flesh-coloured". Later, he listed it under *holoxanthus* with no further comment other than "V" for May (Reichenow 1904, p 92), possibly due to its proximity to Mtoni. However, the eye colour in Reichenow (1891a) confirms that it was indeed *aureoflavus* (and the habitat at Msua does not appear suitable for *holoxanthus*—NEB). Due to confusion of the various similar weavers, Reichenow, Zedlitz and other authors probably did not appreciate the importance of eye colour of males in distinguishing *holoxanthus* from *aureoflavus*.

Both the Mtiras and Msua specimens are thus *aureoflavus* specimens, and Zedlitz did not distinguish *holoxanthus* simply because he never examined a *holoxanthus* specimen, and he certainly did not see the holotype.

The Ruvu Weaver is similar in plumage to the African Golden Weaver, and only two Ruvu Weaver specimens are known. The two ornithologists most familiar with the *holoxanthus* holotype had passed away (Hartlaub in 1900, and Shelley in 1910) by the time of Zedlitz's 1916 paper, otherwise they would probably have criticized his conclusions. It appears as if Reichenow did see the original *holoxanthus* specimens (see Measurements), but these were moved to Tring (and much later to AMNH).

In summary, a series of errors and a lack of critical thinking (Zedlitz), and confusion over the golden weavers caused the disappearance of the species.

Modern sightings and recognition of holoxanthus as a species

In 2003, Fiona Reid (FR) and her husband Graham were birding along the causeway of the Ruvu River floodplain west of Bagamoyo, Tanzania. They realized that the yellow weavers they were watching had dark eyes unlike the orange red eyes of the African Golden Weavers (*subaureus*) they were familiar with in Dar es Salaam. FR continued to watch these birds when conditions allowed and in 2006 shared her descriptions with the Tanzania birds Yahoo group which generated considerable interest and correspondence. In 2009 FR obtained reasonable photographs of these birds and shared these with Don A. Turner (DAT) and Brian Finch (BF) who were familiar with *P. bojeri* on the Kenyan coast. DAT raised the prospect of these birds being *holoxanthus* and BF noted the pale lower mandible of the females which resembled female *P. bojeri* and not those of *aureoflavus*.

In August 2013 NEB had the opportunity to watch and photograph these Ruvu River birds and begin to search for birds upstream of Mtoni. Colonies of known *aureoflavus* within a few kilometres of the Ruvu River were double checked and appeared to be species specific. In February 2013 Alastair Kilpin wrote to NEB regarding photographs of what he had assumed to be *P. bojeri* (but resembled *holoxanthus)* from Lake Tagalala in the Selous Game Reserve (also in PHOWN (PHOtos of Weaver Nests)). Other observers have since submitted sightings and photographs to the Birding Tanzania Facebook group and there are now records from the Wami River by Friedeman Vetter (FV) and, more recently, from Morogoro where Thibaut Chansec and Lily Shallom have independently located small colonies of *holoxanthus*. Walter Jubber and P. Bennet had located further nest sites within the Selous Game Reserve and FV has located a colony on the south bank of the Rufiji River almost opposite a colony of *aureoflavus* on the north bank (all observations are mapped in Fig. 4). Turner & Kennedy (2019) briefly noted the loss of *holoxanthus* and called for a full systematic review of the taxon.

3. Current knowledge

Names

Scientific names assigned to this taxon include *Ploceus holoxanthus* (Hartlaub 1891), *Xanthophilus holoxanthus* (Shelley 1905) and *Sitagra holoxantha* (Sharpe 1909). Although this taxon is not listed in de Silva *et al.* (2019), their classification would place this species in *Malimbus*, while more recent phylogenetic work places this species in the genus *Textor* (Fjeldså *et al.* 2020, Olsson *et al.* in prep.). In this paper the more familiar and long-standing *Ploceus* is used as this paper provides background to the species (primarily known as belonging to *Ploceus*). The reintroduction of the genus *Textor*, however, is likely to become established following Fjeldså *et al.* (2020).

Shelley (1905) gave an English name, Bohndorff's Golden Weaver, after the collector. Currently, Tanzanian birders refer to it as Ruvu Weaver, after its distribution (originally suggested by Fiona Reid, and used in Mills & Leventis 2017), and we propose to keep Ruvu Weaver as its English name.

Measurements

Specimen measurements were given by Hartlaub (1891), Reichenow (1894), Shelley

(1905), and Hartert (1907). These were mostly stated, or implied, to refer to the male holotype individual. Shelley (1905), and presumably Hartert (1907), measured the wing of a female (Table 3).

Hartlaub (1891) provided wing and bill measurements of the male. Reichenow (1894) gave the same wing, but added total bird length, thus he presumably saw the holotype in the hand. Shelley (1905) added several measurements, although in inches. Discrepancies in measurements suggest that these different authors took their own measurements, and thus were familiar with the type specimens. Turner & Kennedy (2019) cited the measurements of Hartert (1907) but mis-cited the tail as 4.5 mm instead of 4.5 cm.

Identification/plumages

Hartlaub (1891) compared male *holoxanthus* with male *aureoflavus* collected from nearby Zanzibar. The primaries of *holoxanthus* are yellow, with the tips being a slightly darker shade, as is the first primary. The outer webs of the secondaries are also a slightly darker shade. In contrast, the wings of *aureoflavus* are pale olive with a yellow outer border and a broader yellow border along the inner webs. In addition, the feather shafts of the wing feathers are light yellow in *holoxanthus* and dark in *aureoflavus*. The back of *aureoflavus* is olive-green, which is hardly noticeable in the (yellow) back of *holoxanthus*. Finally, the golden-brown colour of the head in *holoxanthus* is decidedly more vivid than that of *aureoflavus*. Hartlaub listed the eye colour as dark brown in his Latin description, but did not comment on this being a distinguishing feature.

Shelley (1905) provided a detailed description of the female. He did not list distinguishing features, but mentioned the distinctive two-toned bill colour. Female *aureoflavus* is similar but in breeding females, *aureoflavus* is yellowish below and the bill horn coloured. Non-breeding *aureoflavus* females resemble *holoxanthus* females in underparts (greyish white) and two-toned bill, but the iris of *aureoflavus* is red-brown rather than brown (del Hoyo *et al.* 2010).

Table 3. Measurements of the Ruvu Weaver *Ploceus holoxanthus*; inches converted to millimetres by x 25.4; ad = adult, m = male, f = female, where sex is not stated the presumed sex is placed in square brackets "[ ]".

Measurement	Sex	Original	mm	Source
total length	Ad m	124 mm	124	Hartlaub(1891)
	[m]	L. 130	130	Reichenow(1894)
	Ad m	5 in	127	Shelley (1905)
wing	Ad m	70 mm	70	Hartlaub (1891)
	[m]	F. [=Flugel] 70 mm	70	Reichenow(1894)
	Ad m	wing 2.6	66	Shelley (1905)
	[m]	only 65 to 69 mm	69	Hartert(1907)
wing	Ad f	Wing 2.35	59.7	Shelley (1905)
	[f]	only 65 to 69 mm	65	Hartert (1907)
tail	Ad m	42 mm	42	Hartlaub (1891)
	Ad m	tail 1.7	43.2	Shelley (1905)
	[m]	only 4.5 cm	45	Hartert (1907)
bill	Ad m	14 mm	14	Hartlaub (1891)
	Ad m	culmen 0.65	16.5	Shelley (1905)
tarsus	Ad m	21 mm	21	Hartlaub (1891)
	Ad m	tarsus 0.85	21.6	Shelley (1905)

Table 4. List of published illustrations of the Ruvu Weaver *Ploceus holoxanthus*; all locations are in Tanzania.

Type	Depicting	Observer	Location	Date	Source
painting in publication	male	Henrik Gronvold (artist)	Mtoni	1905	Shelley (1905), Plate 42 Figure 1
photo in publication	male	Adam Scott Kennedy	Selous Game Reserve	Oct-08	Turner (2019), Figure 1
web photo	male, nest	Alastair Kilpin & Gavin Lautenbach	Lake Tagalala in Selous Game Reserve	09-Jan-13	http://weavers.adu.org.za/phown_vm.php?vm=5186
web photo	male, nests	Fiona Reid	Near Bagamoyo	30-May-13	http://weavers.adu.org.za/phown_vm.php?vm=5680
web photo	male, female, nests	Neil Baker	Ruvu Bridge at the end of the causeway	23-Jun-13	http://weavers.adu.org.za/phown_vm.php?vm=5911
web photo	male	Per Holmen	Bagamoyo	10-Jan-16	http://www.pers-birding-pages.com/www.pers-birding-pages.com/Ruvu_Weaver.html
web photo	female	Riaan Marais	Ruvu floodplain	Jul-18	http://www.tanzaniabirds.net/African_birds/weaver_ruvu/ruvu.htm

Several illustrations of *holoxanthus* have been published (Table 4). The holotype (male) was illustrated in a colour painting in Shelley (1905), and a photograph of a male was included in Turner & Kennedy (2019). Three records with photos have been uploaded to PHOWN.

We are aware of slight differences that can occur in the extent of facial orange within and between populations of male *aureoflavus*, *P. bojeri*, *P. castaneiceps* and *holoxanthus*. However, the dark brown eye of the male (Fig. 1) and the pale lower mandible of the female of *holoxanthus* (Fig. 2) distinguish this species from *aureoflavus*. The orange-red iris of adult male *subaureus* is noticeable throughout its range, whereas the orange wash on the face becomes fainter or absent further south (Fig. 3).

Figure 1. Adult male Ruvu Weaver *Ploceus holoxanthus*, 62km upstream of the type locality on the lower Ruvu River at Mtoni. Note the dark brown eye. There are also subtle differences from African Golden Weaver in bill shape and the extent of burnt orange on the face but these are difficult to quantify from photographs (photo: Riaan Marais).

Figure 2. Adult female Ruvu Weaver *Ploceus holoxanthus*, 62km upstream of the type locality on the lower Ruvu River at Mtoni. Note the pale lower mandible, a feature shared with Golden Palm Weaver *P. bojeri* but not with African Golden Weaver *P. subaureus* (photo: Riaan Marais).

Figure 3. Ruvu Weaver *Ploceus holoxanthus* and African Golden Weaver *P. subaureus* bathing side by side, Ruvu River 100 km upstream of Mtoni, Tanzania, 12 September 2015. Left to right: female Ruvu Weaver, male Ruvu Weaver, male African Golden Weaver, Common Bulbul *Pycnonotus barbatus* (photo: Neil E. Baker). This September image is the only one we have of these birds side-by-side utilizing the same habitat (the non-breeding season), and there is still no evidence of them nesting close to each other.

Distribution

The Ruvu Weaver has been recorded on the Ruvu River up to 100 km upstream, on the lower Wami River, and from Lake Tagalala to the Rufiji River in the Selous Game Reserve (Fig. 4). In contrast, populations of *aureoflavus* occur throughout eastern Tanzania.

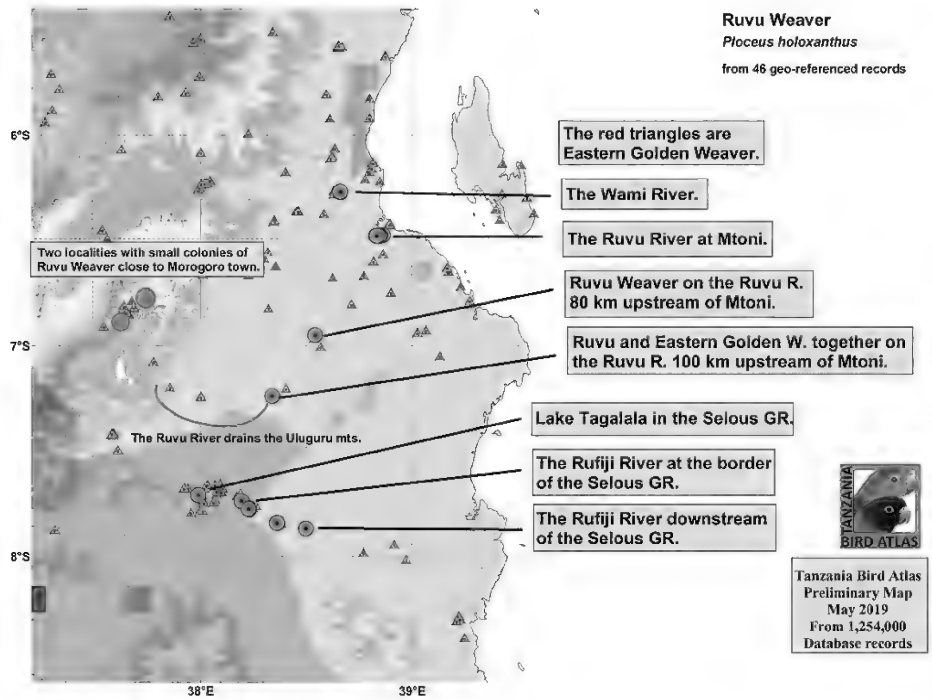

Figure 4. The restricted distribution of Ruvu Weaver *Ploceus holoxanthus* along the Ruvu, Wami and Rufiji rivers in eastern Tanzania. Known observations of the more widespread African Golden Weaver *P. subaureus* are also shown on this map indicating that this species is not restricted to river valleys. Note that some of these claims for African Golden Weaver may be older identification errors for Ruvu Weaver, especially in habitats where both may occur.

It appears for now that *holoxanthus* is restricted to the catchment of the Ruvu, Wami and lower Rufiji rivers in much the same way as Kilombero Weaver *P. burnieri* is restricted to the Kilombero River 150 km upstream from Lake Tagalala (Baker &

Baker 1990). That both are surrounded by large populations of *aureoflavus* suggests that these river populations are in competition with *aureoflavus*. There is some evidence (Tanzania Bird Atlas data) that the population of *aureoflavus* is expanding but none, as yet, to suggest this threatens the far smaller populations of *holoxanthus* or *P. burnieri*.

Breeding biology

Although there are several photos of the nests of *holoxanthus*, there has been no formal description of the nest. From the photos, the nest shape is of the same type as *aureoflavus*, i.e., kidney-shaped with entrance below, and attached from the roof directly to stems. Compared to *aureoflavus*, however, the nest appears less tightly woven and is not as smooth on the outside, resembling the nests of its closest relatives *xanthopterus, bojeri and castaneiceps* (Olsson *et al.*, in prep.). Nests are placed in bushes or bamboos (photos), or in *Phragmites* (N. Baker), along rivers. Colony size was given as 15 nests in a tree (PHOWN number 5186).

Eggs from some nests have been photographed (Fig. 5). An egg from one nest was light blue with very faint mottling (egg 1), and an egg from a second nest was light brown, also with very faint mottling (egg 2). These two eggs were photographed against 1 x 1 mm grid paper, allowing the following measurements to be determined: egg (1) 21 x 15 mm, and egg (2) 19 x 14 mm.

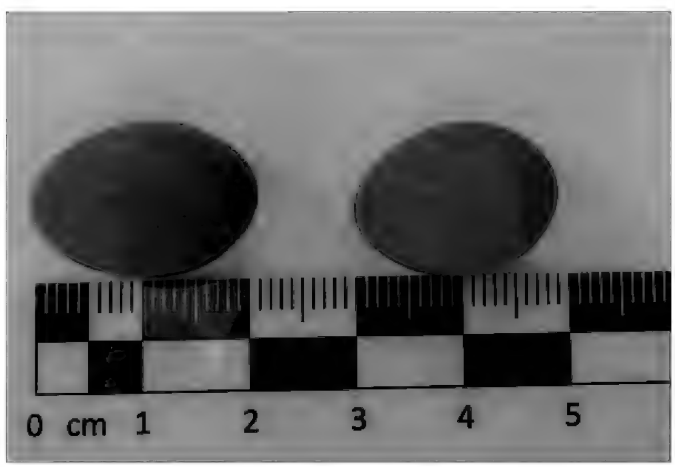

Figure 5. Two eggs (from different nests) of the Ruvu Weaver *Ploceus holoxanthus* (photo: Judith Jarvis).

Molecular phylogenetics

A molecular phylogeny of the Ploceidae was carried out at the University of Gothenburg (Fjeldså *et al.* 2020; Olsson *et al.*, in prep.) and included samples of *holoxanthus*. Contrary to all the early accounts reviewed above, *holoxanthus* is not closely related to *subaureus* (*P. aureoflavus*), which belongs to a distant branch of masked weavers. Instead, *holoxanthus* is the sister species of Southern Brown-throated Weaver *P. xanthopterus*, and they form a clade with, perhaps less surprisingly, *P. bojeri* and *P. castaneiceps* (Fjeldså *et al.* 2020). The females of these four recently diverged weaver species have a two-coloured bill. Fjeldså *et al.* (2020) and Olsson *et al.* (in prep.) firmly reject a close relation with *P. subaureus* and give cause to recognize *holoxanthus* as a valid species.

Conservation status

We have, for now, little to say on the conservation status of this population. Numbers appear to be quite low in the areas we have investigated to date and would suggest a maximum population in the low thousands. Some 140 km upstream of Mtoni a large reservoir is being discussed to provide a constant water supply to Dar es Salaam. Should this project proceed it is likely that the more open habitat would favour colonization by *aureoflavus* rather than *holoxanthus*.

Conclusion

The observations by Fiona Reid of *Ploceus holoxanthus* in the early 2000s have subsequently been confirmed by numerous photos (most unpublished). Mills & Leventis (2017) listed *holoxanthus* as a species, and Turner & Kennedy (2019) drew further attention to the taxon, calling for a full systematic review. A recent molecular phylogeny of the Ploceidae (Fjeldså *et al.* 2020) refutes any close relationship with *subaureus* and places *holoxanthus* as a distinct lineage.

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Population, flocking behaviour and habitat selection of the Grey Crowned Crane *Balearica regulorum* at Lake Ol' Bolossat basin, Kenya

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Summary

Lake Ol' Bolossat is an inland wetland located in Nyandarua County, Kenya that provides critical year-round habitat for the Globally Endangered Grey Crowned Crane *Balearica regulorum gibbericeps*. This study aimed at establishing the population size and density of cranes in the basin, ratio of young to adults (as a measure of productivity), and habitat selection and use during the breeding and non-breeding seasons. Using complete ground counts, five censuses were conducted between 2017 and 2020 with between 521 and 1115 cranes recorded, and we estimate the local population size to be 250–350 individuals. Population density ranged from 0.99–2.18 cranes/km^2 during the breeding and non-breeding seasons respectively. From all 219 observations made during the study period, the mean flock size was 28.21 with a maximum flock size of 332 and a modal flock size of 2–25 individuals. The average proportion of young cranes across all counts was 11.65% indicating a population which is breeding successfully. Although cranes occupied both wetlands and terrestrial habitats in almost equal proportions across the year cumulatively, the difference in choice of habitat between the breeding and the non-breeding seasons was significant (χ^2=489, df=1, p=0.0001), whereby more cranes (mostly paired individuals) were observed in marshes during breeding months. Wheat fields were the most often used of terrestrial habitats among fields of different crop types sampled. Holding 14% and 5% of Kenya's and the global population of Grey Crowned Cranes, respectively, Lake Ol' Bolossat is undoubtedly an important site for this species' conservation and survival.

Keywords: Lake Ol' Bolossat, *Balearica regulorum gibbericeps*, habitat selection, population size, flock characteristics

Introduction

The family Gruidae comprises 15 extant species found in all regions of the world except Antarctica, and only marginally in the Neotropics (Archibald & Meine 1996). The Gruidae have been cited as the most threatened of all bird families in the world (Meine & Archibald 1996), with four species listed as Least Concern, seven as Vulnerable, three as Endangered and one as Critically Endangered (BirdLife International

2020b). The Grey Crowned Crane is the only species present in Lake Ol' Bolossat basin where this study was conducted.

Grey Crowned Cranes occupy mixed wetland-grassland habitats throughout eastern and southern Africa (Walkinshaw 1964). The subspecies *gibbericeps* has been reported as abundant in Kenya, Uganda and Tanzania (Meine & Archibald 1996), with Kenya hosting the largest population (Morrison 2015, BirdLife International 2020). They also occupy agricultural land such as cultivated crop fields (maize, oats, wheat, barley etc.), fallow land and irrigated fields. Morrison (2015) has described this species as an icon of Africa's wetlands and grasslands, thus it is an excellent indicator species of the health of these ecosystems. Its global population has been reported as declining over the years. This was estimated at over 100 000 individuals in 1985 (Urban 1988), 50 000–64 000 individuals in 2004 (Beilfuss *et al.* 2007), and 26 500–33 500 in 2014 (Morrison 2015). As a result, it is listed as Endangered on the IUCN Red List of Threatened Species (BirdLife International 2020c).

The Kenyan population too has been declining. From 1980 to 1999, estimates ranged from 20 000 to 35 000 (Urban *et al.* 1989, Gichuki 1993, Daut 1994), but from 2015 to 2020, numbers reported were much lower at 8000 to 12 500 (Morrison 2015, Wamiti *et al.* 2020). These estimates point to a continuously declining population, conforming to an average loss of 735 cranes per year over a period of 34 years (1985–2019). Although there is a recent national population estimate (Wamiti *et al.* 2020), detailed information from regional strongholds is lacking, including Lake Ol' Bolossat, where the second largest count (1115 individuals) of the species in Kenya has been recorded.

Prior to 2019, Kenya had not conducted a countrywide census to establish its Grey Crowned Crane population. According to Wamiti *et al.* (2020), there had only been two previous attempts, both of which were limited in their coverage. Reporting by the African Waterfowl Census (e.g., Nasirwa *et al.* 2018, Madindou *et al.* 2019), has indicated Lake Ol' Bolossat to be one of the few sites nationally, and sometimes the only site, continuously supporting a high number of cranes.

In Kenya, Lewis & Pomeroy (1989) describe the Grey Crowned Crane as occurring mostly over 500 m above sea level and in areas with over 500 mm of rainfall. Known breeding sites include areas of western Kenya and the Lake Victoria basin, Baringo and Kericho, Narok, Naivasha, and east of the Rift Valley especially around Mt. Kenya and the Aberdares, as well as the Nairobi and Amboseli regions (Brown & Britton 1980). In the study population, the longer (nine months) breeding season usually runs between June and February (when cranes build nests, incubate and rear chicks), while the shorter (three months) non-breeding season lasts between March and May. This classification of seasons is, however, not fixed. It varies from year to year, and is based on a normal local weather pattern on which the cranes' life cycle is in turn dependent. The objective of our study was to describe the characteristics of the Lake Ol' Bolossat population in terms of the size, density, habitat selection and use, age structure as an indicator of breeding productivity (proportion of young/juveniles, immature and sub-adults) as well as its conservation status for management purposes.

Materials and methods

Description of the study area

Lake Ol' Bolossat (0°09' S, 36°26' E) lies at an altitude of 2330 m in the northern reach-

es of Nyandarua County, Kenya (Fig. 1). The lake itself covers an area of 43.3 km^2 (Krhoda 1992). The lake basin is bounded to the east by the steep Satima escarpment rising up to 2530 m and from the base of which approximately ten springs feed Lake Ol' Bolossat. On the gently sloping western margins, formed by the Dundori ridge (2850 m), three rivers drain into the lake at the northwestern end. Water leaves the basin via the Ewaso Narok River that starts at the picturesque 75 m high Nyahururu falls at the north end of the lake. An internal drainage basin, the lake is characteristic of Rift Valley lakes in having a shallow maximum depth of 4 m (Thenya *et al.* 2011), a narrow width of 0.16–3.4 km, and a linear stretch of approximately 30 km. Internationally, the lake is recognized as an Important Bird and Biodiversity Area (Wamiti *et al.* 2009) thus qualifying as a Key Biodiversity Area, and it is also recognized as a site in danger by BirdLife International (2020a). Nationally, the Kenya government has declared an area of 147 km^2 around and including the lake as a Protected Wetland Area through Legal Notice No. 179 of 4 July 2018 (Kenya Law 2018).

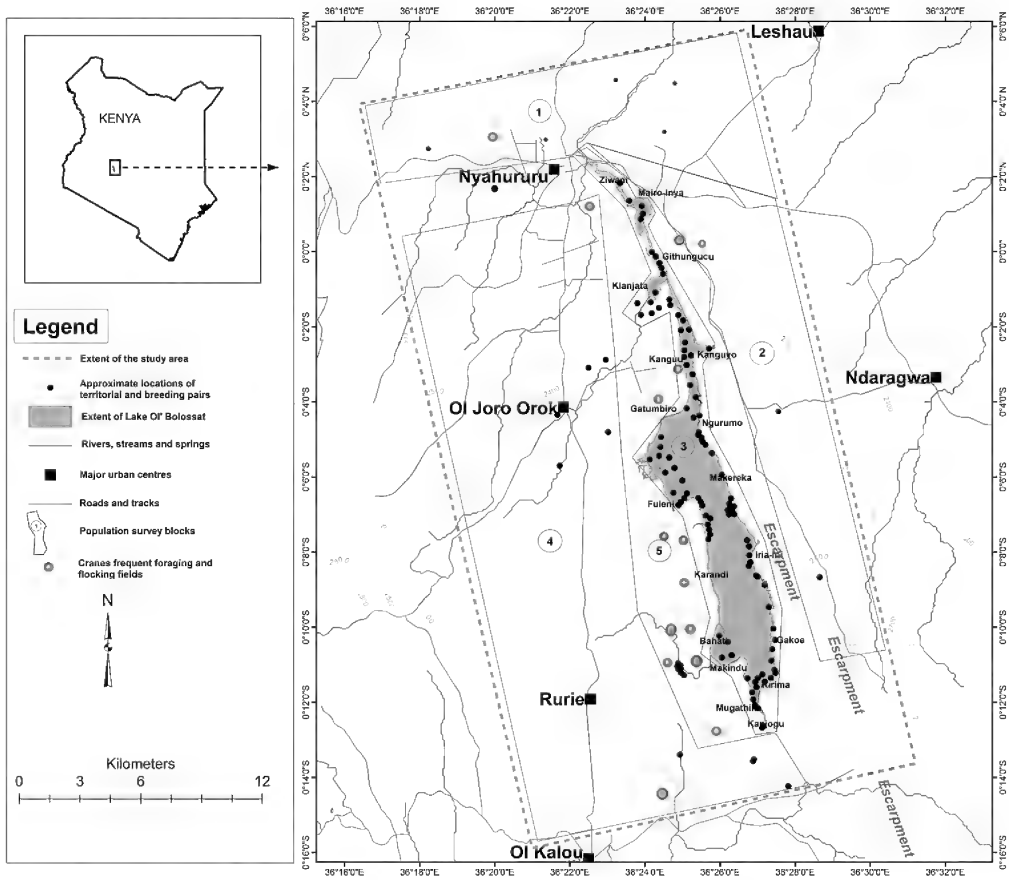

Figure 1. Location of Lake Ol' Bolossat showing the extent of the study area (survey boundary), approximate locations of territorial pairs, major flocking sites and census units (1 = Shamanei-Leshau, 2 = Ndaragwa-Shamata, 3 = shoreline & riparian land, 4 = Nyahururu-Ol' Kalou highway, 5 = foraging fields).

The lake's 43.3 km^2 is comprised of approximately 20 km^2 of permanent marshes, the remainder being open water. It is surrounded by an extensive (though heavily encroached and overgrazed), wet–dry riparian grassland ecosystem that boarders cultivated fields and human settlements. The marshes are dominated by *Cyperus* spp., *Schoenoplectus corymbosus* (Cyperaceae), *Typha* spp. (Typhaceae), and may be interspersed by Swamp Cut Grass *Leersia hexandra* (Poaceae), *Persicaria* spp. (Polygonaceae), *Lythrum rotundifolium* (Lythraceae), Mosquito Fern *Azolla* spp. (Azollaceae) and Kariba Weed *Salvinia molesta* (Salviniaceae). The cultivated crop fields included wheat, oats, barley, peas, potatoes, beans, and fallow fields, whereas the grasslands were either native pasture or playing fields. Fallow agricultural fields were dominated by Ruby Grass (*Rhynchelytrum repens*) and species of the genus *Eragrostis*. The rest of the lake basin is dominated by cultivated fields, natural and plantation forests, rivers, marshes, swamps, man-made water reservoirs, infrastructure (roads, an airstrip, a railway, power transmission lines, etc.), homesteads and urban areas. For greater detail on the conservation threats faced by cranes in Kenya and the Lake Ol' Bolossat, see Wamiti *et al.* (2020).

Data collection

Data were collected for a period of 32 months from December 2017 to July 2020 during which we conducted five censuses: February 2018, October 2018, January 2019, March 2019 and March 2020. Although bird surveys can be undertaken at any time (Pomeroy *et al.* 2018), counting cranes was conducted at approximately the same time, between October and March, for consistency. In most years, this period coincides with the peak of the breeding season in October–January when most breeding pairs have chicks. It is also the time when harvesting and field preparations for crops (maize, wheat, barley, and oats) takes place thus attracting cranes that seek spilled grains. Meanwhile, February and March coincide with the dry season when cranes are known to form flocks, facilitating counting. This time period therefore offers the best opportunities to obtain a minimum population estimate comprised of resident individuals, new recruits (juveniles) and immigrants.

The study area was determined by observing a resident flock of cranes (with some marked individuals) moving between their roosting sites within the lake's marshes and foraging fields nearby. This area was divided into five census units of variable sizes (Fig. 1) and we employed the same approach and team leaders in each count to reduce observer bias in the data collection. Parts within the 646-km^2 study block covered by unsuitable habitats (e.g., forested habitats, major roads, and urban centres) were excluded in determination of the population density, following Gichuki (1993). When these areas (approximately 120 km^2) were excluded, the area of remaining suitable habitat for cranes amounted to 526 km^2.

A complete (true) count over a sample census was chosen since it does not require correcting for detection bias and is recommended for rare species that have a limited, selective choice of foraging fields (Gregory *et al.* 2004). A ground count, reported as the simplest and most common form of counting waterbirds (Wetlands International 2010), was adopted. Ground was covered using a vehicle, motorcycle and on foot (along the lake shoreline). Other researchers have, however, used aerial counts (e.g., Nsengimana *et al.* 2019) and transect-based distance sampling (e.g., Amulike *et al.* 2020) as alternative methods. The entire study area was covered in two days. Day one encompassed the shoreline and the riparian land, and the foraging fields (units

3 and 5; Fig. 1), both holding the majority of the population and accounted for 83% of all the observations. The 80 km long shoreline was split into six sections and each assigned to two teams. Two teams started counting at the same point and walked a transect line along the shoreline in opposite directions to meet another team to conclude. Other units (1, 2 and 4) were counted on day two, mostly targeting breeding and territorial pairs that nest and forage in the lake's satellite wetlands. Except for unit 4 that had a site where cranes flocked, units 1 and 2 supported pairs and/or families that rarely wandered far from their sites. Presence of colour-marked individuals in flocks helped reduce chances of double counting. Counting took place simultaneously over a four-hour period (08:00–12:00) which also helped reduce the chances of double counting.

For each sighting of cranes, the following data were recorded: date, time, number of young and adults, habitat type, estimated field area (ha), and coordinates. Exact counts were made of small flocks (<30 cranes) while medium-sized (31–100 cranes) and larger (>100 cranes) flocks were estimated using a tally counter. Where flocks were tight (i.e., individuals close to each other, frequently mixing), counting was attempted 3 to 4 times and the highest count was used. Two broad age categories of cranes were identifiable in the field (juveniles and adults), and were used in calculating young/adult ratios. Data were divided into breeding and non-breeding seasons.

Results

Standard population measurements

For each of the five complete ground counts conducted, the total number of cranes recorded was: 650 (February 2018), 521 (October 2018), 894 (January 2019), 1115 (March 2019) and 622 (March 2020; mean 760.4, S.E. 107.8, S.D. 240.9). Population size differed significantly across the five censuses ($t_4 = 7.056$, $p = 0.002$). Population densities (cranes/km^2) for each census were: 1.24 (February 2018), 0.99 (October 2018), 1.69 (January 2019), 2.12 (March 2019) and 1.18 (March 2020), with a mean density of 1.44 cranes/km^2.

The mean proportion of young cranes across all five counts expressed as a percentage of the total number of cranes was 11.65% ± 1.140. There was a higher ratio of young recorded in the non-breeding season (12.87% ± 1.434) compared to the breeding season (9.49% ± 1.583) although this difference was non-significant (Welch F test in the case of unequal variances: F = 2.503, df = 209.4, p = 0.1152). This ratio was however significant between the small (12.95%), medium (8.68%) and large (6.45%) sizes of flocks (Welch F test in the case of unequal variances: F = 5.007, df = 51.81, p = 0.0103).

The mean group size was 28.21 cranes/group ($n = 219$, s.e. 3.24, s.d. 47.97, median = 4, mode = 2, range = 1–332) while the modal group size were flocks with 2–25 individuals ($n = 151$, Fig. 2). Half of these smaller flocks (i.e., 2–25 crane groups) were, however, observed as pairs (n = 76). There were a total of 13 flocks with over 100 cranes, 11 of them occurring during the non-breeding season, while the other two were observed during the June breeding season (due to the presence of a *c.* 80 cranes resident flock). There were only four sightings of single individuals, likely partners of incubating pairs.

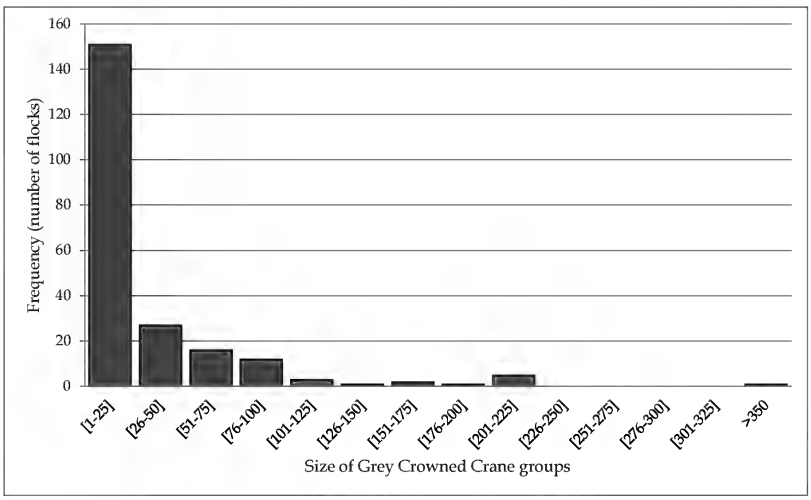

Figure 2. Frequency distribution of Grey Crowned Crane groups observed at Lake Ol' Bolossat basin.

Habitat selection

Cranes were found to utilize both dry/terrestrial and wet habitat substrates for 46% and 54% of observation time respectively. Comparing habitat use between the breeding and the non-breeding seasons, more cranes were observed in wet substrates (wetlands) during the breeding season than during the non-breeding season ($\chi^2=489.28$, df=1, $p=0.0001$). Across all counts, most (35.6%) of the cranes observed were territorial pairs occupying primarily the lake's marshes, followed by wheat fields (29.2%; Table 1). Eight of the 13 largest flocks (i.e., those with over 100 cranes) were recorded in the wheat fields. Cultivated crop fields had the highest diversity of dry substrates (terrestrial habitats) comprising of cereal (barley, maize, wheat, and oats) and other crops (peas, beans and potatoes; Table 1). The size of fields preferred by cranes for foraging ranged from 0.5–130 ha. However, there was only a weak relationship between size of foraging fields and size of crane flocks (Spearman Rank Correlation $r_{108}=0.0011$, $p=0.9909$).

Table 1. Spatial distribution of Grey Crowned Cranes in different habitats and details of observations made during the study period.

Habitat types	No. cranes	No. observations	Mean group size	Proportion (%) of total observations
Cultivated crops fields				
Wheat	3494	64	54.59	29.2
Barley	632	3	210.67	1.4
Fallow	591	9	10.11	4.1
Maize	377	6	62.83	2.7
Oats	253	5	50.60	2.3
Other crops	72	4	18.00	1.8
Grasslands	209	9	23.22	4.1
Wetlands (marshes)				
Lake's edge	741	78	9.50	35.6
Streams/springs	252	19	13.26	8.7
Reservoirs	58	22	2.64	10.1
Total	6179	219		100.0

Discussion and conclusion

Standard population measurements

The Grey Crowned Crane population in the Lake Ol' Bolossat basin has both resident birds and immigrants as shown by the fluctuating number of individuals across the five counts we conducted. We conservatively estimate that the basin has a resident population of between 250 and 350 cranes, based firstly on the findings of Wamiti *et al.*(2020) who established a total of 103 territorial pairs in the lake. We add to this our own observations of 30 additional territorial cranes in satellite wetlands, and an additional resident flock of approximately 80 individuals. This crane population reached a maximum of 1115 cranes during the non-breeding season. Our results show that the Lake Ol' Bolossat basin is a key site for the species given that it holds 14.3% of Kenya's estimated population, and should therefore be monitored annually in both the breeding and non-breeding seasons.

The population density reported in this study of 0.99–2.12 cranes/km^2 compares favourably with Kisii's 1.14 cranes/km^2 (Burke 1965), 1 crane/km^2 in Uganda (Pomeroy 1980), 1.57–2.89 cranes/km^2 in the Kitale area (Gichuki 1993) and Ngorongoro Crater's 2.4 cranes/km^2 during the wet season (Amulike *et al.* 2020). Crane density was observed to vary between the breeding and non-breeding seasons resulting from the arrival and departure of immigrant birds from other areas, although we couldn't determine whence they originated. However, food, nest-sites and rainfall are important factors that are reported as key in influencing this crane's variable local and seasonal movements (del Hoyo *et al.* 1996).

Even though our juvenile data included both fledged and unfledged cranes (as these weren't separated during data collection), our findings of a young/adult ratio of 11.63% is consistent with studies showing a ratio of 10–15% elsewhere, and is indicative of a healthy population (Archibald & Meine 1996). This is especially encouraging given that immediately prior to our study, only a single chick fledged during the entire 2015/2016 breeding season for unknown reasons (Muigai 2016). The improvement in breeding success that we observed may be attributable to the ongoing conservation efforts by Cranes Conservation Volunteers in the study area who have worked to reduce threats such as collection of eggs, removal of chicks, trapping of adults, and minimized livestock disturbances at the nesting sites.

Gichuki & Gichuki (1991) reported a flock size of 2–130 birds at Lake Ol' Bolossat with a mean flock size of 15.4 birds/flock compared to this study's flock sizes of 2–332 individuals and a mean of 28.1 birds/flock. This is perhaps because of our extended period of study (32 months) running over both breeding and non-breeding seasons compared with their five-month study between August and December (breeding season). Large flocks may be more vulnerable to threats such as increased risk of disease and parasite transmission, and at sites where cranes are exposed to conflict with farmers there are high risks of poisoning and trapping because of the crop damage that cranes may cause.

Habitat selection and use

Habitat selection is often related to seasonal changes in foraging ecology (Nowald *et al.* 2018), and as expected, cranes observed in this study occupied a variety of different habitats in different seasons. Small fields (mostly ≤ 0.5 ha) that looked potentially suitable for cranes but were surrounded by wire fencing or hedges were largely avoided. This is probably because cranes prefer open fields with a good view

of approaching danger such as humans and feral dogs. Cranes were observed to favour more open adjacent areas, even if these small fields contained preferred forage. Hence, security is perhaps more important than food in choice of a foraging site. The choice of a foraging field also appeared to be affected by factors such as proximity to human disturbance, a crop's stage and type, and the size/area of the field.

Compared to the steeply sloping and intensively farmed eastern side of the lake with limited open habitats, the gently sloping western side had higher crane concentrations due to presence of large farms that allow mechanized farming, especially in the wheat farms. Cranes roosted on trees, in marshes and shallow water at the lake edge, in small to medium-sized flocks, pairs or family groups. The lake has three main roosting sites in the south and central sections, and a fourth in a nearby man-made reservoir, Robert's dam. Identification of roosting sites is important because cranes are especially concentrated at these, and therefore especially vulnerable to disturbance. Roosts are important in dictating habits of cranes such as local dispersion and use of foraging habitats (Allan 1996). Furthermore, knowledge of roosting sites may offer important future opportunities for censussing cranes with multiple simultaneous counts.

Cranes that foraged in grasslands and fallow fields often occurred together with livestock. Pairs with chicks were also seen pecking on dry and fresh cattle dung, perhaps looking for insects such as larvae and adult dung beetles. As food availability became scarce, cranes left the fields but would return immediately after they were burned or ploughed, to take advantage of unburned waste grains or sowed seeds that might be exposed.

Ring recoveries

During the period of this study, two adult cranes bearing colour rings were observed (G. Muigai, pers. comm.; 2 March 2019). We confirmed that these birds were ringed at Lake Ol' Bolossat between July 1988 and March 1989, at the age of one month old (Gichuki & Gichuki pers. comm.). These individuals present new information on longevity in a wild Grey Crowned Crane, with the age of 32 years being 12 years older than the previous record of 20 years old (Allan 1996).

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Further additions to the avifauna of the Isunkaviola Plateau, Ruaha National Park, south-central Tanzania, emphasize its ornithological importance

Jasson R. John and Halima Kiwango

Summary

Isunkaviola Plateau is located in the western part of Ruaha National Park, south-central Tanzania, and is a remote and infrequently visited area. Previous ornithological work there has revealed some notable range extensions, and in this paper, we detail the results of surveys conducted in October 2019, to supplement species inventories provided by Glen *et al.* (2005) and Glen (2011). We provide detection probabilities for 114 species encountered during 55 census point counts, and document two species that are new for Ruaha NP; the Scaly Francolin *Pternistis squamatus* and Green Twinspot *Mandingoa nitidula*. Five additional species were also added to this list from mist netting. We categorize forest dependence for all species recorded on the plateau and indicate those with strong preference for higher altitudes. To date, a total of 148 bird species have been recorded within the Isunkaviola area, further illustrating the critical value of a small elevated and forested area within a broad savanna ecosystem. Given its unique avifauna, the Isunkaviola Plateau remains as an important birding site within Ruaha National Park, and therefore, improving accessibility and awareness will not only open the area for avitourism, but also encourage further biodiversity research.

Keywords: Avitourism, forest-dependent bird species, high altitude miombo woodland, Ruaha National Park

Introduction

The Isunkaviola Plateau is located in the remote western part of the Ruaha National Park (Fig. 1). Ruaha National Park is the second largest national park (20 226 km^2) in Tanzania after the recently (2019) established Nyerere National Park, with an area of 30 000 km^2 (formerly part of Selous Game Reserve; Tanzania National Park 2020). Unlike most of Ruaha National Park which is covered by miombo woodland (also known as *Brachystegia*; Baker & Baker 2002, Glen 2011), bushed grasslands (Williams 1967) and the wetlands of Ihefu (Marttila 2011), the Isunkaviola Plateau supports rich mature woodlands and forested riverine habitats at an elevation of approximately 1550–1870 m. Because of its altitude, the plateau possesses unique and rare habitats within the National Park such as riverine and *Drypetes* climax forests (Glen *et al.*

2005). The remaining hinterlands within Ruaha National Park are part of an undulating plateau at an altitude of around 1000 m.

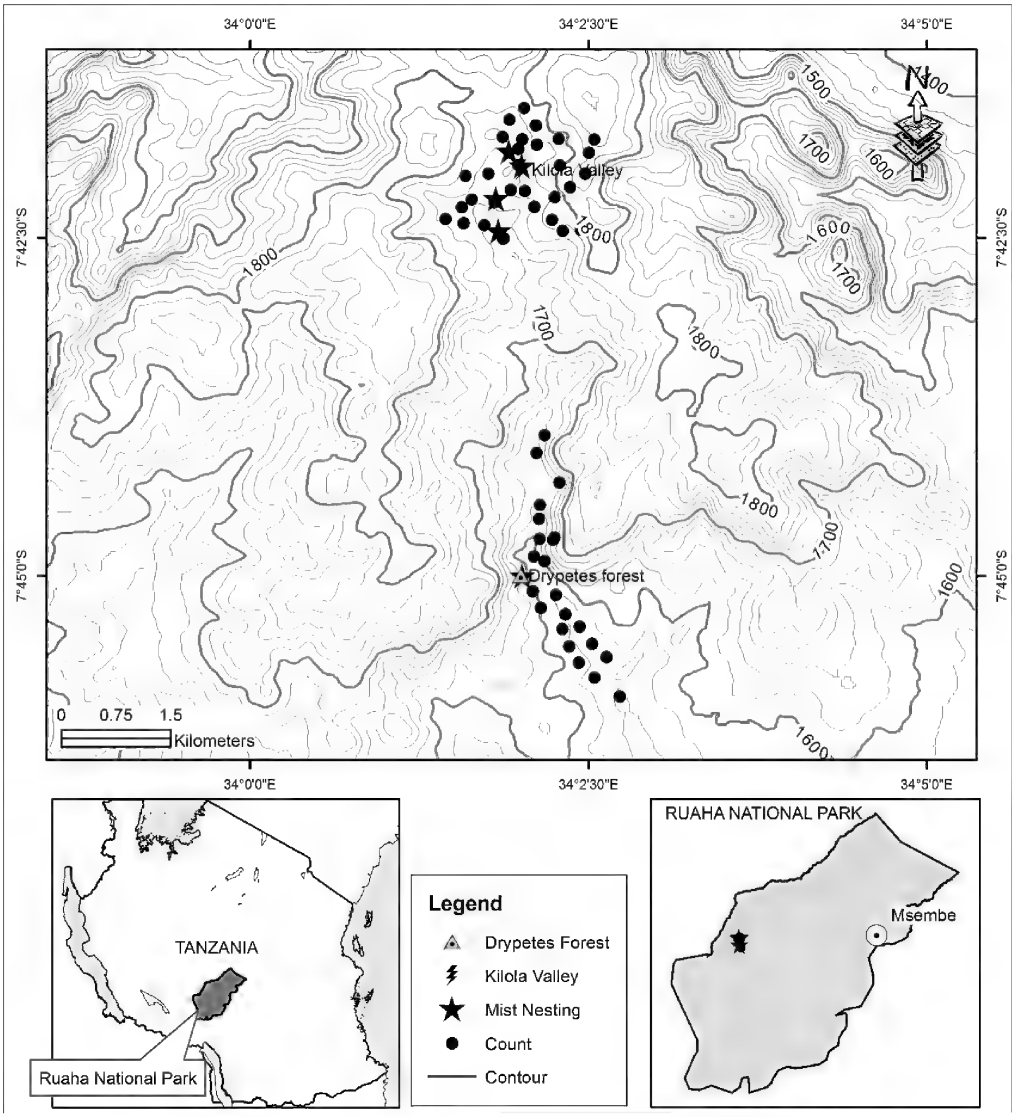

Figure 1. Map of the study area showing sampling points. Msembe is the Park Headquarters, located at along the eastern margins of the Park.

Due to the difficulty of accessibility, much of the biodiversity of this area remains undocumented, although there have been visits for vegetation surveys between 1973 and 1976 (Bjornstad 1976), and information on small mammals has been published by Stanley *et al.* (2015). Visits for systematic bird surveys were conducted between 2001 and 2004 (Glen *et al.* 2005) and further information is given in the unpublished annotated checklist of the Ruaha National Park (Glen 2011). There is no recent published information on the status of the birds of this area. Moreover, the role of the *Drypetes* forest and riverine habitats has not been extensively studied, and given the

potential for avitourism within the Great Ruaha-Rungwa ecosystem, the birdlife of the area should be documented further.

Glen *et al.* (2005) and Glen (2011) reveal that much of the birdlife of the Isunkaviola Plateau is unique within Ruaha National Park showing affinities with the forest avifaunas of both the eastern Congo and Eastern Arc Mountains. Fieldwork at the Isunkaviola Plateau in early 2000s (Glen *et al.* 2005) identified 17 bird species with range extensions at this location. Of those, 11 were species recognized as forest dependent or species known to be indicators of true forest habitat (see Glen 2011 for further information).

Here, in addition to presenting the status (detection probability) of species recorded during avifaunal surveys in October 2019, we categorize species by forest dependence and highlight those species with a strong preference for high elevations. Including additional species recorded by Glen (2011), we provide a comprehensive species list for the Isunkaviola Plateau, further illustrating the ornithological importance of this little-known wilderness area of Ruaha National Park.

Methods

Study area

In addition to habitats surveyed in previous visits by Glen *et al.* (2005), we extended our surveys to cover surrounding miombo woodlands at Isunkaviola Plateau. By contrast, the study by Glen *et al.* (2005) sampled mainly the *Drypetes* section (07°45′ S, 34°02′ E) and Kilola Valley (07°42′ S, 34°02′ E; Fig. 1). The riverine forest of the Kilola Valley at Isunkaviola is approximately 4 km long and 100 m wide (Glen *et al.* 2005) with adjoining fingers of forest following small tributaries. These streams, springs and marshes provide year-round surface water in the Kilola Basin, and are especially important for wildlife towards the end of the dry season (September–November).

Field methods

We used point-counts and mist netting to census birds in the study area following Ralph *et al.* (1993). All point-count and mist netting locations were geo-referenced using a hand-held GPS, and later mapped (Fig. 1). With the exception of marshy and swampy areas, canopy cover at sampling sites for point-counts, varied from 10–90% (51.66 ± 19.47, $n = 50$), whereas the canopy height varied from 3–40 m (15.88 ± 10.7, $n = 50$). At our mist netting site, the canopy cover varied from 60–80% (73.0 ± 9.74, $n = 5$) whereas the canopy height varied from 15–30 m (24.6 ± 7.47, $n = 5$). Both survey methods were conducted simultaneously with two separate teams from 9–17 October 2019 while camping in the survey area.

Point counts

Census points were established along the Kilola Valley in the *Drypetes* forest section, and in the adjacent miombo woodland. Fifty five census points were established between 1568 m and 1860 m and were spaced at least 250 m from each other (Fig. 1). Within the Kilola Valley, census points were established following altitudinal gradients, with parallel points within the riverine forest and adjacent woodlands. All birds (seen and heard) within a 50 m radius were identified and counted within 10-min periods at each point. Our survey team also included an experienced field assistant, Maneno Mbilinyi, well versed in local bird vocalizations. The first five minutes of each point count conducted was spent recording details of vegetation canopy cover and canopy height.

Mist netting

Four mist nets of 12 m-length were placed at selected points within the Kilola Valley, and in *Drypetes* forest. A total of five sites were selected to cover as much of the variation within the riverine forest as possible, and mist nets were run from 0600–1830 hrs for two to three consecutive days at each location, and were checked at least every 30–40 mins. Nets were placed either parallel or perpendicular to the valley depending on the landscape orientation. Trapped birds were identified and marked (wings marked by a marker pen to recognize recaptures) and released. Mist nets were placed at altitudes from 1613–1776 m (Fig. 1).

Data analysis

We derived estimates of detection probability as a proportion of the number of points ($n = 55$) on which a species was recorded. Species were also classified according to ecological niche as either: forest specialists (*FF*), forest generalists (*F*), forest visitors (*f*) or non-forest (*nf*) species as per Britton (1980), Bennun *et al.* (1996), Harrison *et al.* (1997) and Bowie *et al.* (2004), and using our local field experience. Species elevation preferences (m) are based on those provided by Britton (1980) and Bowie *et al.* (2004).

Taxonomy and nomenclature follows the Handbook of Birds of the World and BirdLife International (2019), except concerning the taxonomic rank of Ruaha Chat *Myrmecocichla collaris* where we follow Glen *et al.* (2011) and Aliabadian *et al.* (2012).

Results and Discussion

Species richness and relative abundance

A total of 114 bird species were recorded from 55 point-counts, comprising a total of 805 individual birds (Appendix 1). New species recorded for Ruaha National Park (Glen 2011) included Scaly Francolin *Pternistis squamatus,* which was seen briefly (and also heard once near the camp) at 1802 m on 12 October 2019. This is presumably the rare subspecies *udzungwensis,* known from 120 km to the east in the Iringa Highlands (Britton 1980). Another new addition to the Ruaha National Park species list is the Green Twinspot *Mandingoa nitidula,* with a female trapped in riverine forest at 1761 m on 13 October 2019. This is a secretive bird and can easily be overlooked, but being a nocturnal migrant, it can occur widely in forest habitat (N. Baker, pers. comm.).

From a total of 7104 metre-net hours, 44 individual birds of 18 species were caught in mist nets (Appendix 2). The most commonly trapped birds were Grey-olive Greenbul *Phyllastrephus cerviniventris* (Fig. 2), Olive Sunbird *Cyanomitra olivacea,* African Paradise-flycatcher *Terpsiphone viridis* and Bleating Camaroptera *Camaroptera brachyura.* Five bird species: Tambourine Dove *Turtur tympanistria,* African Hill-babbler *Sylvia abyssinica,* Green Twinspot *Mandingoa nitidula,* Western Violet-backed Sunbird *Anthreptes longuemarei* and Grey Tit-flycatcher *Fraseria plumbea* were caught in mist nets, but were not recorded during point-count surveys in the adjacent woodlands. Some of these are skulking species (e.g., African Hill-babbler, Green Twinspot), and although vocal, the African Hill-babbler can be easily overlooked (Bradley *et al.* 2018). All six species captured showed a preference for riverine forest habitat within the wider area surveyed.

A further 29 bird species which have been previously reported from the Isunkaviola Plateau (Glen *et al.* 2005, Glen 2011) were not recorded on our surveys (Appendix 3).

Figure 2. One of eight Grey-olive Greenbuls *P. cerviniventris* captured on the Isunkaviola Plateau, Ruaha NP, during field surveys in October 2019; it seems probable that a controversial report of the congeneric Leaflove *P. scandens* in Glen *et al.* (2005), which was questioned by Fishpool (2009), in fact refers to this species (photo: Juma Joseph Minya).

Forest dependence and altitudinal preference

Unlike most areas in Ruaha National Park, the altitude and habitats of the Isunkaviola Plateau support species of highlands and forest habitat (Bowie *et al.* 2004, Romdal & Rahbek 2009, Fjeldså *et al.* 2010). In this study alone, we recorded six forest specialists: African Olive-pigeon *Columba arquatrix*, Olive Sunbird *Cyanomitra olivacea*, African Broadbill *Smithornis capensis*, Crowned Eagle *Stephanoaetus coronatus*, African Hill-babbler and Green Twinspot. Other highland and/or forest specialists known from Isunkaviola Plateau but not recorded on our surveys include White-tailed Crested-flycatcher *Elminia albonotata*, Eastern Crested-flycatcher *Trochocercus bivittatus*, Forest Double-collared Sunbird *Cinnyris fuelleborni*, Lemon Dove *Aplopelia larvata* and Waller's Starling *Onychognathus walleri* (Bowie *et al.* 2004, Glen *et al.* 2005, Glen 2011). Of the remaining species that we recorded on our surveys, 11 are forest generalist, while 55 are forest visitors (Appendices 1–2).

The Isunkaviola Plateau is unique within the Ruaha ecosystem in hosting both forest-dependent and highland species, as well as a further 71 species of non-forest habitats (Appendices 1–3). These high altitude relictual montane and riverine forests comprise important niches supporting high biodiversity (Stolberger 2005, Stanley *et al.* 2015).

Conclusion

The remote Ruaha wilderness zone and little explored Isunkaviola Plateau comprise an interesting ornithological location. The riverine and *Drypetes* forests are unique and rare habitats within Ruaha National Park and support a distinctive assemblage of forest-dependent and high altitude species. The absence of some species that were previously recorded at this site, and the low detection rates in this study, can best be explained by: (i) limited survey efforts or species habitat restrictions, and, (ii) the possibility that there could be some seasonality and local movement of species there. Further studies, extending to lower altitudes in both cold and hot seasons could provide additional information on this little known aspect of birdlife in the National Park.

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Appendix 1. The 114 bird species recorded from point counts surveys, their ecological niches (forest dependence and association with high elevation) and detection probability at Isunkaviola Plateau, Ruaha National Park. The Scaly Francolin *Pternistis squamatus* was recorded for the first time in the park. Abbreviations: FF = forest specialist, F = forest generalist, f = forest visitor, nf = non-forest species.

English name	Scientific name	Forest dependence	Highland species	Detection Probability
Hildebrandt's Francolin	*Pternistis hildebrandti*	nf		0.02
Scaly Francolin	*Pternistis squamatus*	F		0.07
Coqui Francolin	*Peliperdix coqui*	nf		0.04
African Olive-pigeon	*Columba arquatrix*	FF	*	0.04
Red-eyed Dove	*Streptopelia semitorquata*	f		0.07
Ring-necked Dove	*Streptopelia capicola*	f		0.04
African Green-pigeon	*Treron calvus*	f		0.05
White-browed Coucal	*Centropus superciliosus*	nf		0.04
Black Cuckoo	*Cuculus clamosus*	f		0.02
Klaas's Cuckoo	*Chrysococcyx klaas*	f		0.04
African Emerald Cuckoo	*Chrysococcyx cupreus*	f	*	0.04
Red-chested Cuckoo	*Cuculus solitaries*	f		0.20
Black Crake	*Zapornia flavirostra*	nf		0.05
Purple-crested Turaco	*Gallirex porphyreolophus*	f		0.13
Schalow's Turaco	*Tauraco schalowi*	f		0.27
Hadada Ibis	*Bostrychia hagedash*	nf		0.02
Hamerkop	*Scopus umbretta*	nf		0.04
African Scops-Owl	*Otus senegalensis*	nf		0.02
African Wood Owl	*Strix woodfordii*	F	*	0.02
Verreaux' Eagle Owl	*Bubo lacteus*	nf		0.02
Bateleur	*Terathopius ecaudatus*	nf		0.07
Crowned Eagle	*Stephanoaetus coronatus*	FF		0.02
Wahlberg's Eagle	*Hieraaetus wahlbergi*	nf		0.02
Gabar Goshawk	*Micronisus gabar*	nf		0.02
African Grey Hornbill	*Lophoceros nasutus*	nf		0.07
Crowned Hornbill	*Lophoceros alboterminatus*	f		0.07
Common Hoopoe	*Upupa epops*	nf		0.11
Green Woodhoopoe	*Phoeniculus purpureus*	nf		0.07
Common Scimitarbill	*Rhinopomastus cyanomelas*	nf		0.09
European Bee-eater	*Merops apiaster*	f		0.11
Racquet-tailed Roller	*Coracias spatulatus*	nf		0.22
Broad-billed Roller	*Eurystomus glaucurus*	f		0.05
Brown-hooded Kingfisher	*Halcyon albiventris*	f		0.02
Striped Kingfisher	*Halcyon chelicuti*	nf		0.04
Crested Barbet	*Trachyphonus vaillantii*	nf		0.07
Whyte's Barbet	*Stactolaema whytii*	nf	*	0.04
Yellow-rumped Tinkerbird	*Pogoniulus bilineatus*	F	*	0.09
Red-fronted Tinkerbird	*Pogoniulus pusillus*	nf		0.02
Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*	nf		0.02
Black-collared Barbet	*Lybius torquatus*	nf	*	0.11
White-faced Barbet	*Pogonornis macclounii*	F		0.02
Lesser Honeyguide	*Indicator minor*	f		0.05
Greater Honeyguide	*Indicator indicator*	f		0.13

English name	Scientific name	Forest dependence	Highland species	Detection Probability
Cardinal Woodpecker	*Dendropicos fuscescens*	f		0.15
Brown-necked Parrot	*Poicephalus fuscicollis*	f	*	0.02
Brown Parrot	*Poicephalus meyeri*	nf		0.05
African Broadbill	*Smithornis capensis*	FF		0.04
Eastern Black-headed Oriole	*Oriolus larvatus*	f		0.44
African Golden Oriole	*Oriolus auratus*	f		0.04
White-breasted Cuckooshrike	*Ceblepyris pectoralis*	f		0.07
Black Cuckooshrike	*Campephaga flava*	f		0.09
White-crested Helmetshrike	*Prionops plumatus*	nf		0.07
Retz's Helmetshrike	*Prionops retzii*	f		0.04
Chinspot Batis	*Batis molitor*	nf		0.09
Black-throated Wattle-eye	*Platysteira peltata*	f	*	0.04
Grey-headed Bush-Shrike	*Malaconotus blanchoti*	nf		0.02
Black-backed Puffback	*Dryoscopus cubla*	f		0.40
Marsh Tchagra	*Bocagia minuta*	nf		0.02
Brown-crowned Tchagra	*Tchagra australis*	nf		0.04
Fork-tailed Drongo	*Dicrurus adsimilis*	nf		0.29
Black-crowned Tchagra	*Tchagra senegalus*	nf	*	0.27
Brubru	*Nilaus afer*	nf		0.02
Orange-breasted Bush-shrike	*Chlorophoneus sulfureopectus*	f		0.04
Tropical Boubou	*Laniarius aethiopicus*	f	*	0.24
African Paradise-flycatcher	*Terpsiphone viridis*	f		0.20
Common Fiscal	*Lanius collaris*	nf		0.02
Yellow-bellied Hyliota	*Hyliota flavigaster*	f		0.04
Red-faced Crombec	*Sylvietta whytii*	nf		0.02
Green-capped Eremomela	*Eremomela scotops*	f		0.04
Yellow-breasted Apalis	*Apalis flavida*	f		0.02
Brown-headed Apalis	*Apalis alticola*	F	*	0.11
Miombo Wren-warbler	*Calammonastes undosus*	nf		0.11
Bleating Camaroptera	*Camaroptera brachyura*	f		0.11
Red-faced Cisticola	*Cisticola erythrops*	nf		0.02
Trilling Cisticola	*Cisticola woosnami*	nf		0.18
Tawny-flanked Prinia	*Prinia subflava*	f		0.05
African Yellow Warbler	*Iduna natalensis*	nf	*	0.02
Moustached Grass-warbler	*Melocichla mentalis*	nf		0.02
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	nf		0.02
Fan-tailed Grassbird	*Schoenicola brevirostris*	nf	*	0.02
Grey-rumped Swallow	*Pseudhirundo griseopyga*	nf		0.11
White-headed Saw-wing	*Psalidoprocne albiceps*	f	*	0.02
Lesser Striped Swallow	*Cecropis abyssinica*	nf		0.02
Mosque Swallow	*Cecropis senegalensis*	nf		0.07
Red-rumped Swallow	*Cecropis daurica*	nf	*	0.02
Barn Swallow	*Hirundo rustica*	nf		0.04
Red-throated Rock Martin	*Ptyonoprogne rufigula*	nf	*	0.02
Grey-olive Greenbul	*Phyllastrephus cerviniventris*	F		0.02
Common Bulbul	*Pycnonotus barbatus*	f		0.45
Willow Warbler	*Phylloscopus trochilus*	f		0.09
African Yellow White-eye	*Zosterops senegalensis*	f		0.07
Violet-backed Starling	*Cinnyricinclus leucogaster*	f		0.35

English name	Scientific name	Forest dependence	Highland species	Detection Probability
Arrow-marked Babbler	*Turdoides jardineii*	nf		0.05
Yellow-billed Oxpecker	*Buphagus africanus*	nf		0.02
Greater Blue-eared Starling	*Lamprotornis chalybaeus*	nf		0.05
Kurrichane Thrush	*Turdus libonyana*	nf		0.16
Miombo Scrub-robin	*Tychaedon barbata*	nf		0.15
White-browed Scrub-robin	*Cercotrichas leucophrys*	nf		0.02
African Dusky Flycatcher	*Muscicapa adusta*	F	*	0.04
White-browed Robin-chat	*Cossypha heuglini*	f		0.20
Collared Sunbird	*Hedydipna collaris*	f		0.07
Olive Sunbird	*Cyanomitra olivacea*	FF		0.05
Amethyst Sunbird	*Chalcomitra amethystina*	f		0.24
Western Miombo Sunbird	*Cinnyris gertrudis*	nf		0.09
Variable Sunbird	*Cinnyris venustus*	f		0.05
Spectacled Weaver	*Ploceus ocularis*	f		0.05
Holub's Golden Weaver	*Ploceus xanthops*	nf		0.11
Jameson's Firefinch	*Lagonosticta rhodopareia*	nf		0.02
Common Waxbill	*Estrilda astrild*	nf		0.02
Bronze Mannikin	*Spermestes cucullata*	nf		0.13
Yellow-throated Bush-sparrow	*Gymnoris superciliaris*	nf		0.07
African Pipit	*Anthus cinnamomeus*	nf		0.02
African Pied Wagtail	*Motacilla aguimp*	nf		0.02
Cabanis's Bunting	*Emberiza cabanisi*	f		0.02

Appendix 2. The 18 bird species caught in mist nets at Isunkaviola Plateau, Ruaha National Park, in October 2019. The Green Twinspot *Mandingoa nitidula* was recorded for the first time in Ruaha National park. Abbreviations: *FF*=forest specialist, *F*=forest generalist, *f*=forest visitor, *nf*=non-forest species, #=not recorded during point counts.

English name	Scientific name	Forest dependence	Highland species	No. of individuals caught
Tambourine Dove#	*Turtur tympanistria*	F		1
Cardinal Woodpecker	*Dendropicos fuscescens*	f		1
African Broadbill#	*Smithornis capensis*	FF		2
White-crested Helmetshrike	*Prionops plumatus*	nf		3
Black-crowned Tchagra	*Tchagra senegalus*	nf		1
Fork-tailed Drongo	*Dicrurus adsimilis*	nf		1
African Paradise-flycatcher	*Terpsiphone viridis*	f		6
Bleating Camaroptera	*Camaroptera brachyura*	f		5
Trilling Cisticola	*Cisticola woosnami*	nf		1
Grey-olive Greenbul	*Phyllastrephus cerviniventris*	F		8
African Hill-babbler	*Sylvia abyssinica*	FF	*	1
Grey Tit-flycatcher#	*Fraseria plumbea*	f		1
White-browed Robin-chat	*Cossypha heuglini*	f		2
Western Violet-backed Sunbird#	*Anthreptes longuemarei*	f	*	1
Olive Sunbird	*Cyanomitra olivacea*	FF		6
Amethyst Sunbird	*Chalcomitra amethystina*	f		2
Green Twinspot#	*Mandingoa nitidula*	FF		1
Yellow-throated Bush-sparrow	*Gymnoris superciliaris*	nf		1

Appendix 3. The 29 bird species not recorded at Isunkaviola during our October 2019 field surveys but reported previously by Glen *et al.* (2005) and/or Glen (2011). Abbreviations: *FF* = forest specialist, *F* = forest generalist, *f* = forest visitor, *nf* = non-forest species.

English name	Scientific name	Forest dependence	Highland species
Shelley's Francolin	*Scleroptila shelleyi*	nf	
Lemon Dove	*Aplopelia larvata*	FF	*
Dusky Turtle-dove	*Streptopelia lugens*	f	
Mozambique Nightjar	*Caprimulgus fossii*	nf	
Mottled Spinetail	*Telacanthura ussheri*	f	
Thick-billed Cuckoo	*Pachycoccyx audeberti*	f	
Crowned Lapwing	*Vanellus coronatus*	nf	
Common Greenshank	*Tringa nebularia*	nf	
Spotted Eagle-owl	*Bubo africanus*	nf	
White-backed Vulture	*Gyps africanus*	nf	
Dark Chanting-goshwak	*Melierax metabates*	nf	
Augur Buzzard	*Buteo augur*	nf	
Eastern Crested-flycatcher	*Trochocercus bivittatus*	FF	
White-tailed Crested-flycatcher	*Elminia albonotata*	FF	*
Eastern Nicator	*Nicator gularis*	F	
Lazy Cisticola	*Cisticola aberrans*	nf	
Black Saw-wing	*Psalidoprocne pristoptera*	f	*
Pearl-breasted Swallow	*Hirundo dimidiata*	nf	
Yellow-bellied Greenbul	*Chlorocichla flaviventris*	f	
Red-winged Starling	*Onychognathus morio*	f	
Waller's Starling	*Onychognathus walleri*	FF	*
White-eyed Slaty-flycatcher	*Melaenornis fischeri*	F	*
White-starred Robin	*Pogonocichla stellata*	F	*
Red-capped Robin-chat	*Cossypha natalensis*	F	
Ruaha Chat	*Myrmecocichla collaris*	f	
Green-headed Sunbird	*Cyanomitra verticalis*	f	*
Forest Double-collared Sunbird	*Cinnyris fuelleborni*	FF	*
East African Citril	*Crithagra hyposticta*	f	*
Black-eared Seedeater	*Crithagra mennelli*	f	

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A bird survey of the Budalang'i Flood Plain, Busia County, Kenya

Oliver Nasirwa

Summary

A seven-day survey of birds was carried out in the Budalang'i Flood Plain area in May 2019. Twenty line transects totalling 24.83 km in length were covered using the distance sampling technique. A total of 6149 individuals of 151 bird species were recorded. Species associated with farmlands (*Ploceus pelzelni* and *Columba guinea*) and wetlands (*Anastomus lamelligerus*) were the most frequently encountered and numerous. The Oluhongo Swamp, which is part of the northern extension of Yala Swamp Important Bird Area, had the highest species richness and diversity. Papyrus endemics and threatened swamp-dependent species such as *Laniarius mufumbiri*, *Cisticola carruthersi*, *Crithagra koliensis*, *Muscicapa aquatica*, *Acrocephalus gracilirostris* and *Bradypterus carpalis* were recorded. Two individuals of the Endangered *Balearica regulorum* were recorded as well. No Palaearctic migrant species were recorded as it was outside the migration period. Habitat loss and pressure resulting from drainage of swamps to reclaim land, strengthening of dykes to reduce the impact of the floods, pollution and extension of agricultural activities continue to threaten the future existence of these endemic and endangered species.

Keywords: species, richness, abundance, diversity, wetlands

Introduction

Birds play many roles in an ecosystem including as predators, pollinators, scavengers, seed dispersers, seed-eaters, and ecosystem engineers (Whelan *et al.* 2008). These roles in many ways impact human health, economy, and food production, both directly and indirectly (Şekercioğlu *et al.* 2016). The Budalang'i Flood Plain is renowned for frequent flooding that leads to displacement of residents, and destruction and loss of property (Makhanu *et al.* 2007). The escalation of humanitarian concerns is blamed on increased frequency, force and severity of floods and droughts. The increased impact of the floods and droughts is attributed to climatic change exacerbated by the rapid ecological transformation of the area. This ecological transformation could be basically described as changes in land use driven by increased settlements and infrastructure developments. The consequence of this transformation is the declining state of natural habitats as well as the presence and abundance of wildlife species, including birds. Baseline information on birds in this flood plain has not been documented. The northwestern corner of the Yala Swamp Important Bird Area (IBA) overlaps with this area (Bennun & Njoroge 1999). Birdlife International (2020) in their recent review indicated that the Yala Swamp is an IBA in danger. Hence the aim of this study was to provide baseline information on bird species occurrence, richness, abundance, distribution, and diversity in this area that is adjacent to the Yala Swamp.

Bird taxonomy and nomenclature follow the fourth edition of the *Checklist of the Birds of Kenya* (EANHS 2009) and English names are given in the Appendix.

Study area

The Budalang'i Flood Plain area extends between longitudes 33°56′30″ to 34°10′30″E and latitudes 0°0′30″S to 0°11′30″N and covers part of Siaya County and Busia County (Onywere *et al.* 2007). This area is the lowest part of the Nzoia River catchment and basin. It stretches for about 20 km from Rwambwa Bridge westwards to the river mouth at Bukoma Beach on the shore of Lake Victoria (Fig. 1). The River Nzoia meanders through this relatively flat area of the flood plain that slopes from an altitude *c.* 1148 m to *c.* 1135 m. The river, with its meandering in the flood plain area is estimated to be 40 km in length. This area is characterized by riparian herbaceous vegetation and open grasslands fragmented by a mosaic of small-scale farms as well as patchy papyrus-dominated swamps. The northwestern corner of the Yala Swamp IBA is part of this study area (Bennun & Njoroge 1999). The main activities of the local people in the Budalang'i Flood Plain are small-scale farming, livestock grazing, fishing and riverbed sand harvesting at a subsistence level.

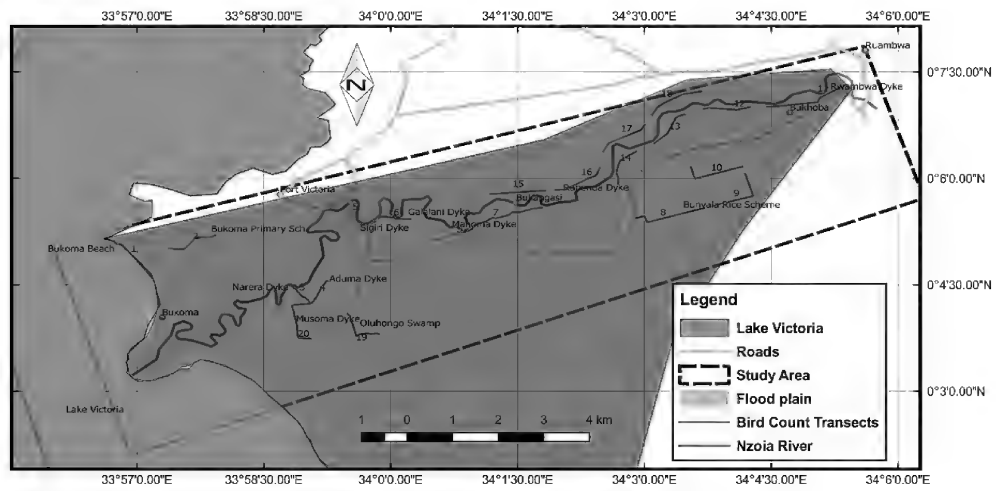

Figure 1. Map of the Budalang'i Flood Plain study area showing bird survey transects (May 2019).

The area receives bimodal rainfall with long rains experienced in April–May and short rains in the October–November period. The average annual rainfall is relatively low, estimated at about 800 mm. These rains are also known to fail occasionally, leading to periodic droughts. The Nzoia River provides water for irrigation in Budalang'i all year round. Several instances of severe floods have been recorded in the past. The floods result from water supplied by Nzoia River and its tributaries from the high rainfall areas upstream (Wepukhulu & Rees 2015). The floods deposit sediment that contributes to the area's good agricultural production. There are dykes on either side of the river that measure a total length of 34.6 km. Of these, 16.2 km in length of the dykes are on the northern banks and 18.4 km on the southern banks (Otiende 2009). These dykes were built to reduce the impact of the floods.

Methods

A survey was carried out in the Budalang'i Flood Plain from 22–29 May 2019. This survey sampled the flood plain from Rwambwa Bridge to the river mouth at Bukoma Beach on Lake Victoria. The transects covered Bukoma Beach, swamp edges, streams and river-banks in the flood plain, roads in the Bunyala Rice Irrigation Scheme, and the dykes. Generally, all transects cut across areas of mosaic habitat that were fairly open, including the papyrus swamp edge areas. Distance sampling technique was employed using two observers. Each transect was covered within a time period of one hour. The observers were equipped with pairs of binoculars (with magnification of 10 x 42). One of the observers was dedicated to recording the data, but also assisted in the identification and counting of birds seen.

All the bird species seen and/or detected by their calls were identified, counted and their perpendicular distance to the transect line estimated. Each bird sighted was recorded independently and where there was a tight flock, the distance from the mid-point of the flock was recorded as the perpendicular distance of the birds to the transect. The data were analysed using the R software. The bird species accumulation curves, species richness and diversity indices were calculated using 'Vegan' version 2.5–6. The abundance was estimated using Rdistance version 2.1.3. The probability of detection and abundance was estimated for each species independently. Species whose observations were below the minimum number required to fit the detection function were excluded in the estimation of the overall density.

Results

A total of 20 transects totalling 24.83 km in length were covered by the survey over a period of seven days. A total of 6149 individuals of 151 species were recorded. The transect information, species richness, diversity, evenness, density and number of individuals counted are summarized in Table 1.

Table 1. Transect information, species richness, diversity and number of individuals counted during the bird surveyed in the Budalang'i Flood Plain, May 2019.

Site name	Transect number	Transect length (m)	Shannon-Wiener (H)	Species richness	No. of birds counted	Density (birds/ha)
Bukoma Beach	1	880	2.357	32	349	9.91
Bukoma Primary	2	1170	3.389	37	101	2.16
Narera Dyke	3	690	2.776	35	183	6.63
Aduma Dyke	4	700	2.861	30	122	4.36
Sigiri Dyke	5	1000	2.844	37	174	4.35
Galalani Dyke	6	1000	2.771	32	186	4.65
Mahoma Dyke	7	2000	2.927	47	357	4.46
Bunyala Rice Scheme1	8	1700	2.897	35	361	5.31
Bunyala Rice Scheme2	9	1600	2.039	27	657	10.27
Bunyala Rice Scheme3	10	1400	1.465	20	1259	22.48
Rwambwa1	11	2000	3.590	49	181	2.26
Rwambwa2	12	1000	2.911	30	125	3.13
Rwambwa3	13	1000	1.894	21	126	3.15
Rwambwa4	14	1000	3.248	37	133	3.33
Rapenda1	15	1200	3.629	51	284	5.92
Rapenda2	16	1200	1.428	41	691	14.40
Rapenda3	17	1200	3.007	29	150	3.13
Rapenda4	18	1300	3.173	47	266	5.12
Oluhongo Swamp	19	1160	3.588	52	248	5.34
Musoma Dyke	20	1630	3.507	46	196	3.01
Total	20	24830		151	6149	30.70

The species accumulation curve with the effort of covering twenty transects tended towards an asymptote which indicates that 151 species was a good estimate of the species richness for the area at the time of the study (Fig. 2).

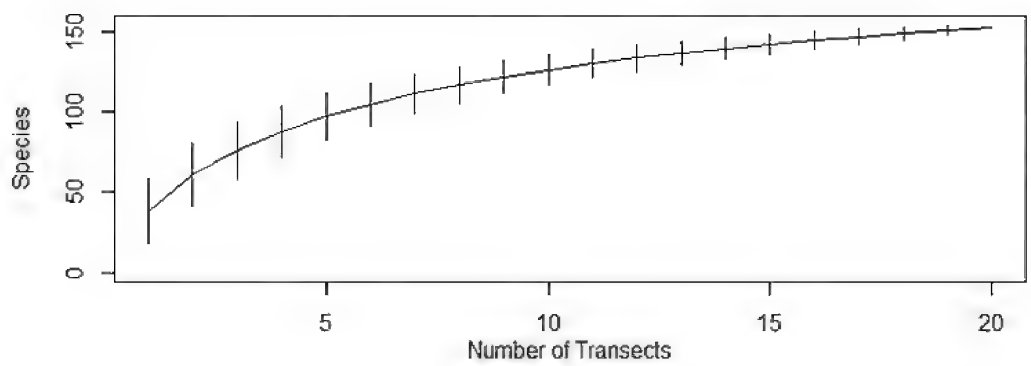

Figure 2. Bird species accumulation curve for the Budalang'i Flood Plain area, surveyed in May 2019.

The most numerous species encountered was *Anastomus lamelligerus* with 680 individuals, followed by *Columba guinea* with 673 individuals and *Ploceus pelzelni* with 448 individuals (see Appendix). The most encountered species was *Pycnonotus barbatus* 54 times, followed by *Laniarius erythrogaster* 46 times and *Cisticola galactotes* 44 times. The most abundant species was *Ploceus pelzelni* with a density of 4.40 birds/ha, followed by *Anastomus lamelligerus* with 2.38 birds/ha and *Columba guinea* with 2.37 birds/ha (Table 2).

Table 2. Estimated density of fourteen most abundant bird species in the Budalang'i Flood Plain, surveyed in May 2019.

Common name	Rank	Estimated density birds/ha	CI 95%	
			Low	High
Ploceus pelzelni	1	4.40	0.33	13.67
Anastomus lamelligerus	2	2.38	0.24	8.93
Columba guinea	3	2.37	0.18	6.21
Ploceus melanocephalus	4	2.22	1.16	3.78
Ploceus cucullatus	5	1.64	0.70	4.15
Egretta garzetta	6	1.52	0.21	4.61
Pycnonotus barbatus	7	1.50	0.85	2.49
Sarkidiornis melanotos	8	1.10	0.13	3.79
Colius striatus	9	1.02	0.43	2.25
Ploceus jacksoni	10	0.89	0.35	1.86
Euplectes axillaris	11	0.88	0.40	1.76
Cisticola galactotes	12	0.81	0.41	1.37
Ceryle rudis	13	0.78	0.32	1.60
Bubulcus ibis	14	0.75	0.28	1.57
Total	All	30.65	21.79	46.98

Discussion

This study brings out the current status of habitats and bird species in the Budalang'i Flood Plain. An estimate of 30 birds/ha for the entire study area is conservative since species whose number of observations fell below the minimum detection required were not included in deriving this estimate. In general, the most abundant and frequently encountered species were those associated with the farms. *Anastomus lamelligerus, Dendrocygna viduat*a and *Egretta garzetta* are waterbirds that were associated with the flooded rice paddies and canals in the Bunyala Irrigation Rice Scheme. The common farmland birds were *Euplectes axillaris, Ploceus melanocephalus* and *P. cucullatus*. *Columba guinea, E. axillaris, P. melanocephalus* and *P. cucullatus* were among the main species that people were employed to scare away from the farms.

The Oluhungo swamp area, with 52 species, had the highest number. This swamp also recorded the presence of papyrus endemic species like *Laniarius mufumbiri, Cisticola carruthersi, Crithagra koliensis* and *Bradypterus carpalis*. With more intensive searches, it is very possible that the other papyrus endemic species such as *Chloropeta gracilirostris* could be found, and in higher abundance, in the swamps at Oluhongo and south of Bukoma Beach, which extends into the Yala Swamp IBA. Considering that this study area is adjacent to the Yala Swamp IBA, these data and information are important as baseline for assessing the ongoing ecological transformations that continue to threaten the highlighted endemic species in western Kenya. This study was done outside the Palaearctic migration period: species richness is expected to be higher during October to March when migrant species are present.

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Appendix. List of all bird species, number of individuals and their percentage frequency recorded during the survey in Budalang'i Flood Plain in May 2019. Taxonomy and nomenclature follow the fourth edition of the *Checklist of the Birds of Kenya* (EANHS 2009).

English name	Scientific name	Number of individuals	Number of encounters
Helmeted Guineafowl	*Numida meleagris*	13	3
White-faced Whistling Duck	*Dendrocygna viduata*	32	8
Fulvous Whistling Duck	*Dendrocygna bicolor*	357	5
Spur-winged Goose	*Plectropterus gambensis*	4	3
Knob-billed Duck	*Sarkidiornis melanotos*	141	10
Egyptian Goose	*Alopochen aegyptiaca*	4	1
Yellow-billed Stork	*Mycteria ibis*	3	2
African Open-billed Stork	*Anastomus lamelligerus*	680	20
Sacred Ibis	*Threskiornis aethiopicus*	4	1
Hadada Ibis	*Bostrychia hagedash*	32	11
Glossy Ibis	*Plegadis falcinellus*	14	2
African Spoonbill	*Platalea alba*	42	5
Little Bittern	*Ixobrychus minutus*	2	1
Black-crowned Night Heron	*Nycticorax nycticorax*	2	1
Striated Heron	*Butorides striata*	1	1
Squacco heron	*Ardeola ralloides*	6	4
Cattle Egret	*Bubulcus ibis*	223	26
Grey Heron	*Ardea cinerea*	4	4
Black-headed Heron	*Ardea melanocephala*	11	9
Purple Heron	*Ardea purpurea*	3	3
Great White Egret	*Ardea alba*	21	3
Little Egret	*Egretta garzetta*	265	21
Hamerkop	*Scopus umbretta*	69	19
Great White Pelican	*Pelecanus onocrotalus*	48	2
Reed Cormorant	*Phalacrocorax africanus*	8	6
African Black-shouldered Kite	*Elanus caeruleus*	9	7
Black Kite	*Milvus migrans*	1	1
Black-chested Snake Eagle	*Circaetus pectoralis*	1	1
Western Banded Snake Eagle	*Circaetus cinerascens*	3	3
African Harrier Hawk	*Polyboroides typus*	2	2
Gabar Goshawk	*Micronisus gabar*	1	1
Long-crested Eagle	*Lophaetus occipitalis*	7	6
Black Crake	*Amaurornis flavirostra*	4	2
Purple Swamphen	*Porphyrio porphyrio*	2	1
Grey Crowned Crane	*Balearica regulorum*	4	2
Water Thick-knee	*Burhinus vermiculatus*	8	4
Black-winged Stilt	*Himantopus himantopus*	76	3
Long-toed Plover	*Vanellus crassirostris*	29	4
Spur-winged Plover	*Vanellus spinosus*	47	10
Brown-chested Plover	*Vanellus superciliosus*	20	1
African Jacana	*Actophilornis africanus*	40	14
Speckled Pigeon	*Columba guinea*	674	15
African Mourning Dove	*Streptopelia decipiens*	46	20
Red-eyed Dove	*Streptopelia semitorquata*	51	24
Ring-necked Dove	*Streptopelia capicola*	4	1

English name	Scientific name	Number of individuals	Number of encounters
Laughing Dove	*Streptopelia senegalensis*	13	7
Emerald-spotted Wood Dove	*Turtur chalcospilos*	4	3
Blue-spotted Wood Dove	*Turtur afer*	74	38
African Green Pigeon	*Treron calvus*	7	2
Meyer's Parrot	*Poicephalus meyeri*	3	2
Eastern Grey Plantain-eater	*Crinifer zonurus*	31	12
Jacobin Cuckoo	*Clamator jacobinus*	1	1
Red-chested Cuckoo	*Cuculus solitarius*	13	11
Klaas's Cuckoo	*Chrysococcyx klaas*	3	3
Diederik Cuckoo	*Chrysococcyx caprius*	12	10
Blue-headed Coucal	*Centropus monachus*	10	8
White-browed Coucal	*Centropus superciliosus*	14	10
African Palm Swift	*Cypsiurus parvus*	13	6
White-rumped Swift	*Apus caffer*	4	1
Speckled Mousebird	*Colius striatus*	89	31
Blue-naped Mousebird	*Urocolius macrourus*	10	4
Broad-billed Roller	*Eurystomus glaucurus*	14	5
Grey-headed Kingfisher	*Halcyon leucocephala*	30	22
Woodland Kingfisher	*Halcyon senegalensis*	16	13
Malachite Kingfisher	*Alcedo cristata*	11	8
Pied Kingfisher	*Ceryle rudis*	109	24
Little Bee-eater	*Merops pusillus*	1	1
White-throated Bee-eater	*Merops albicollis*	37	6
Green Wood-hoopoe	*Pheoniculus purpureus*	5	2
Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*	3	3
Black-billed Barbet	*Lybius guifsobalito*	1	1
Greater Honeyguide	*Indicator indicator*	3	2
Nubian Woodpecker	*Campethera nubica*	2	1
Black-headed Batis	*Batis minor*	4	2
Grey-headed Bushshrike	*Malaconotus blanchoti*	1	1
Marsh Tchagra	*Tchagra minutus*	5	4
Black-crowned Tchagra	*Tchagra senegalus*	2	1
Papyrus Gonolek	*Laniarius mufumbiri*	20	6
Black-headed Gonolek	*Laniarius erythrogaster*	99	46
Grey-backed fiscal	*Lanius excubitoroides*	23	12
Black-headed Oriole	*Oriolus larvatus*	1	1
Common Drongo	*Dicrurus adsimilis*	16	9
African Paradise Flycatcher	*Terpsiphone viridis*	9	4
White-headed Saw-wing	*Psalidoprocne albiceps*	7	4
Black Saw-wing	*Psalidoprocne pristoptera*	7	4
Plain Martin	*Riparia paludicola*	65	3
Barn Swallow	*Hirundo rustica*	12	4
Blue Swallow	*Hirundo atrocaerulea*	2	1
Lesser Striped Swallow	*Cecropis abyssinica*	44	13
Winding Cisticola	*Cisticola galactotes*	76	44
Carruthers's Cisticola	*Cisticola carruthersi*	10	3
Zitting Cisticola	*Cisticola juncidis*	1	1
Tawny-flanked Prinia	*Prinia subflava*	15	10

English name	Scientific name	Number of individuals	Number of encounters
Grey-capped Warbler	*Eminia lepida*	61	40
Grey-backed Camaroptera	*Camaroptera brachyura*	41	25
Common Bulbul	*Pycnonotus barbatus*	175	54
Little Rush Warbler	*Bradypterus baboecala*	4	3
White-winged Swamp Warbler	*Bradypterus carpalis*	10	6
Greater Swamp Warbler	*Acrocephalus rufescens*	5	5
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	1	1
Red-faced Crombec	*Sylvietta whytii*	2	1
Black-lored Babbler	*Turdoides sharpei*	26	5
African Yellow White-eye	*Zosterops senegalensis*	4	1
Rüppell's Starling	*Lamprotornis purpuroptera*	59	21
Red-billed Oxpecker	*Buphagus erythrorhynchus*	7	4
Yellow-billed Oxpecker	*Buphagus africanus*	8	2
African Thrush	*Turdus pelios*	16	13
White-browed Robin Chat	*Cossypha heuglini*	4	3
Brown-backed Scrub Robin	*Cercotrichas hartlaubi*	4	4
Northern Black Flycatcher	*Melaenornis edolioides*	8	5
Swamp Flycatcher	*Muscicapa aquatica*	14	7
Amethyst Sunbird	*Chalcomitra amethystina*	6	3
Scarlet-chested Sunbird	*Chalcomitra senegalensis*	2	2
Beautiful Sunbird	*Cinnyris pulchellus*	8	5
Marico Sunbird	*Cinnyris mariquensis*	51	22
Red-chested Sunbird	*Cinnyris erythrocercus*	12	4
Variable Sunbird	*Cinnyris venustus*	3	2
Superb Sunbird	*Cinnyris superbus*	2	1
Copper Sunbird	*Cinnyris cupreus*	4	2
White-browed Sparrow Weaver	*Plocepasser mahali*	8	2
House Sparrow	*Passer domesticus*	5	2
Kenya Rufous Sparrow	*Passer rufocinctus*	2	1
Grey-headed Sparrow	*Passer griseus*	21	8
Baglafecht Weaver	*Ploceus baglafecht*	2	1
Slender-billed Weaver	*Ploceus pelzelni*	448	13
Little Weaver	*Ploceus luteolus*	45	15
Spectacled Weaver	*Ploceus ocularis*	1	1
Lesser Masked weaver	*Ploceus intermedius*	21	4
Village Weaver	*Ploceus cucullatus*	192	23
Yellow-backed Weaver	*Ploceus melanocephalus*	270	43
Golden-backed Weaver	*Ploceus jacksoni*	97	18
Cardinal Quelea	*Quelea cardinalis*	14	4
Red-billed Quelea	*Quelea quelea*	68	3
Black Bishop	*Euplectes gierowii*	14	8
Southern Red Bishop	*Euplectes orix*	12	2
Fan-tailed Widowbird	*Euplectes axillaris*	156	34
Common Waxbill	*Estrilda astrild*	43	6
Black-crowned Waxbill	*Estrilda nonnula*	1	1
Red-cheeked Cordon-bleu	*Uraeginthus bengalus*	31	12
Brown Twinspot	*Clytospiza monteiri*	4	1
Red-billed Firefinch	*Lagonosticta senegala*	16	10

English name	Scientific name	Number of individuals	Number of encounters
Bronze Mannikin	*Spermestes cucculatus*	71	14
Pin-tailed Whydah	*Vidua macroura*	28	8
Village Indigobird	*Vidua chalybeata*	13	8
African Pied Wagtail	*Motacilla aguimp*	25	12
Plain-backed Pipit	*Anthus leucophrys*	2	1
African Citril	*Crithagra citrinelloides*	3	2
Papyrus Canary	*Crithagra koliensis*	2	1
Reichenow's Seedeater	*Crithagra reichenowi*	4	2
Yellow-fronted Canary	*Crithagra mozambica*	21	8
Brimstone Canary	*Crithagra sulphurata*	2	1
Total number of individuals		6149	
Total number of species		151	

Short communications

Grey Crowned Cranes *Balearica regulorum* are gregarious rather than social

It has long been known that Grey Crowned Cranes *Balearica regulorum*, in common with most other crane species, are usually seen in pairs—or sometimes several pairs together—and are believed to mate for life (Pomeroy 1980a, Urban *et al.* 1986). Sighting of a single crane is often considered to be evidence for its mate being at a nest. Apart from the few months when they are nesting, Grey Crowned Cranes form flocks, occasionally as many as 2000 in Kenya (Gichuki & Gichuki 1991), but the largest in Uganda are only a few hundreds, and most flocks are much smaller.

For at least ten years, a flock of Grey Crowned Cranes (hereafter simply cranes) spends most of the day feeding on Kampala's main rubbish dump at Kiteezi, some 12 km north of the city centre. Other birds that feed on the dump include Marabou Storks *Leptoptilos crumeniferus* (sometimes more than a thousand of them), Cattle Egrets *Bubulcus ibis* and Pied Crows *Corvus albus*. At times (but not always, T. Kitongo, pers. comm.), the cranes return to their roosting places during the day, then most go back to the dump for a final feed in the afternoon. The roosting sites are 1–2 km west of the feeding sites. Most of the cranes roost on the ground, in a large field, sometimes with cows, whilst others roost on tall high voltage pylons in the same area, often with Hooded Vultures *Neophron monachus* and Marabou Storks.

From a balcony on my house, between 18:00 and 19:00 (but mostly near sunset, which, at that time, was at 18:55), I can watch and count many of the cranes as they make their evening flight back towards their roosts. For 25 evenings between 6 June 2020 and 2 July 2020, I recorded each group separately (taking a group as separate from any other if there is a gap of 50 m or more between them; and, for this purpose, including single birds as a 'group of one'; Table 1). Although immatures can be recognized for most of their first-year (Pomeroy 1980b), they were not distinguishable in flight at a distance. On three evenings, the numbers counted exceeded 50—the highest count being 55—and this probably means that the whole flock was seen on that day. On other days, some may have left early, while others will have followed routes not visible from the balcony.

As can be seen from the results, group sizes varied from 1 to 24. Interestingly, in a much larger crane population in Kenya, the commonest group size was similar to this (Wamiti *et al.* 2021). Larger groups sometimes form loose V-shapes, but birds move about within the flocks (making counting more difficult, but in most cases each flock was counted twice as a check). Of the 168 groups counted, only 91 had an even number of cranes, and the commonest group was of single birds. And even-numbered groups could contain two singles. The results also show that on a few evenings, some birds flew in the opposite direction; it is hard to see why.

It is obvious from the table that groups varied in composition from day to day. Gichuki & Gichuki (1991) found that during the day, foraging flocks also varied in size with time, from 15 to 60, with maxima in mid-morning and mid-afternoon. The

results show that occasionally, as with groups of 18 on successive days (13th and 14th, and again 16 June), it is possible that these were the same birds staying together, though there are few such instances. It would appear that the 50-plus flock was made up of many pairs and a good number of lone individuals, but there was very little cohesion amongst the flock as a whole; hence, gregarious rather than social. Almost all cranes in Uganda breed on seasonal wetlands outside protected areas (Olupot *et al.* 2009), and in southern Uganda they can breed in June and July (Pomeroy 1980a), but all possible wetlands within at least 10 km of the roost have been drained and in many cases, built on. Therefore, if any of the single birds have a partner on a nest, it must be a long way away, which seems unlikely. However, much as the basic groups are of one or two birds, more individuals joined larger groups, of four or more—882 as compared to 59 in the smaller groups.

Table 1. Groups and numbers of Grey Crowned Cranes at Kiteezi in June–July 2020. Each symbol represents one record. The penultimate column gives actual flock sizes where they were more than 16 in number. Y = cranes flying towards roost area. O = cranes flying back towards dump. These were not counted in the daily totals, but were included in group totals.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Others	Sum
6-Jun	Y	Y	YY	Y		Y				Y								29
7	Y		Y														17	21
9	Y	Y		Y											Y	Y		38
11	Y	YY								Y							22	37
12		YYYY				Y		YY						Y				44
13						Y											18	24
14		YO	Y			Y											18	29
15	YY		YY	Y								YY						36
16				YY													18	26
17		Y						Y			Y						21	42
18								Y			Y							19
19				Y		Y	YY	Y	Y	Y								51
20		YY														Y	19	39
21	OYYY	OY	YYY			Y		Y									18	46
22	YYYY	Y		YY					Y	Y		Y						44
23	YY	YY		Y										Y			20	44
24	O	Y	Y		Y			OY					Y					30
25	YYYY	Y		Y		YY								Y			18	53
26	YY			YYY	Y			Y	Y									36
27	YY	Y				Y	Y						Y				18	48
28		Y	YYY			Y				Y	Y						17	53
29		Y		Y	Y	YY		Y	Y									40
30	OOY	Y		YY		Y						Y					24	52
1-Jul	YY					Y	Y		Y	Y								34
2	O	OY	Y					Y		Y							24	45
Total	30	25	14	16	3	13	4	11	5	7	3	4	2	3	1	2	(14)	951

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First records of the Green-capped Eremomela subspecies *Eremomela scotops pulchra* from southern Tanzania

As part of ongoing research on the taxonomy of the Green-capped Eremomela *Eremomela scotops* complex, two specimens were uncovered from southern Tanzania representative of the subspecies *E. s. pulchra*. This taxon appears to be unrecognized in East Africa (Britton 1980, Urban *et al.* 1997), and this note serves to formally document its presence in the region. The two specimens are:

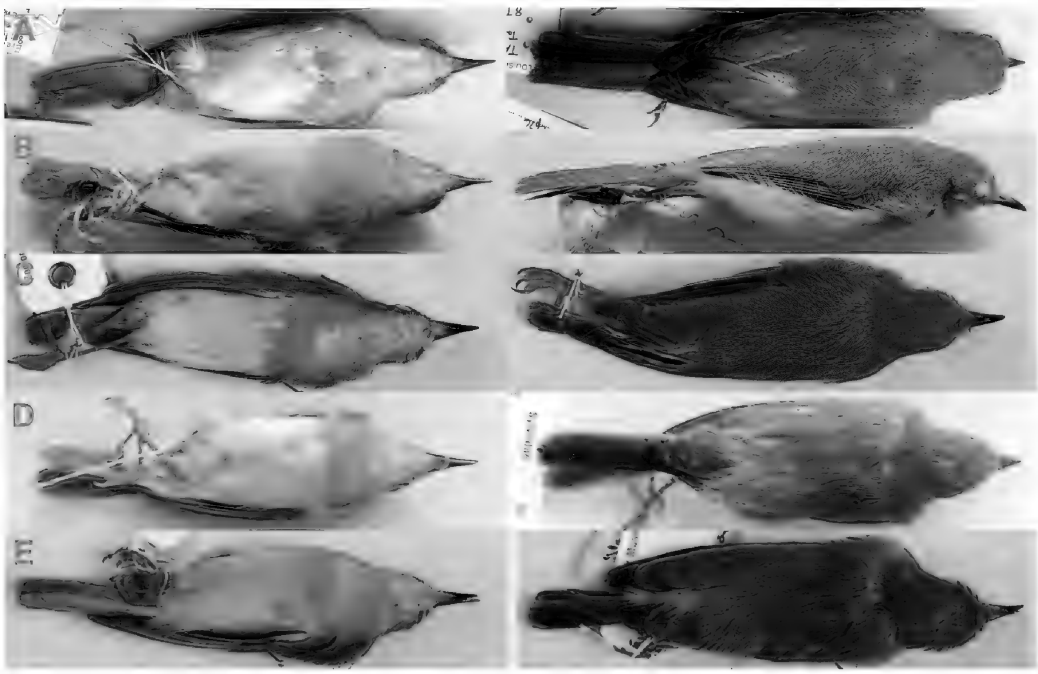
1. Louisiana State University #138973; male, collected 8 Jun 1989 @ 1700 m in Sumbawanga District, Tanzania (*c.* 8°29′S, 31°30′E). Measurement details (mm) collected are: wing 59.9, tail 47.7, bill (nares to tip) 6.9. (Fig. 1; A)
2. National Museums of Kenya #17150; male, iris creamy white, collected 11 Sep 1956 @ 1525 m 48 km north of Tunduma, Tanzania (*c.* 8°53′S, 32°51′E). Measurement details collected are: wing 57, tail 47.4, bill 7.3. (Fig. 1; B)

Both of these specimens show features consistent with *pulchra* but neither of the other two subspecies that may be found in southern Tanzania, specifically:

1. The underparts show a clear and sharp demarcation from yellow throat and breast to white abdomen, which is consistent with *E. s. pulchra* and *E s. citriniceps*, but not eastern *E. s. occipitalis* which shows the yellow of the throat blending across most if not all of the lower underparts (Fig. 1; E).
2. The dorsal surface shows the grey of the mantle extending to the occiput, a feature shown by *E. s. pulchra* and *E. s. occipitalis* but not *E. s. citriniceps*, in which the brighter golden olive of the crown extends to the rear of the head where it is sharply demarcated from the grey mantle (Fig. 1; C, D).
3. The colour of the irides noted for the Tunduma specimen (Fig. 1; B) is creamy white, which is inconsistent with the dark, wine red irides of *E. s. citriniceps* (hazel in juveniles), those being unique to that subspecies. Furthermore, the thighs show white feathering, which is always contrasting yellow in *citriniceps* when visible (Fig. 1; C).
4. The wing and tail measurements for both specimens fall within 2 mm of the average for those metrics in a sample of 57 *E.s. pulchra*, while the tail length measured for both specimens exceeds the maximum tail length in both *E. s. occipitalis* and *E. s. citriniceps*, from samples of 53 and 23 of each, respectively (JB unpub. data).

While label details for the Sumbawanga specimen do not record the colour of the irides, an important difference between *E. s. citriniceps* and *E. s. pulchra*, the extent of grey on the crown in combination with the measurement details is sufficient to be confident of the identification. This view is supported by the collector (D. Moyer pers. comm.).

Figure 1. Tanzanian specimens of *E. s. pulchra* from Sumbawanga District (A; photos by S. Cardiff) and from north of Tunduma (B; photos by D. Chesire), alongside examples of *E. s. citriniceps* from west Tanzania (C; see Fjeldså 2015a) and Burundi (D; photos by R. Marie Lafontaine), and an example of *E. s. occipitalis* from southeast Tanzania (E; see Fjeldså 2015b). Photographs are not to scale.



It should be noted that a third specimen of the Green-capped Eremomela from this southern region of Tanzania (on the Ufipa Plateau), was assigned to *E. s. citriniceps* (Grant & Mackworth-Praed 1942). Though not assessed for this short note, a contemporary re-evaluation of this material is almost certain to point to identification as *E. s. pulchra*. At the time of collection, *pulchra* was not known from as close to southern Tanzania as northern Zambia, and more importantly, the difference in eye colour between *pulchra* and *citriniceps* as well as other distinguishing characteristics, were not widely appreciated. Therefore then, and subsequently (e.g. Chapin 1953), there have been apparent difficulties in satisfactorily assigning specimens to either of these superficially similar taxa (JB unpub. data).

Immediately to the south of the East African region, *E. s. pulchra* is common in Katanga Province of southeast Democratic Republic of Congo and throughout Zambia (Chapin 1953, Dowsett *et al.* 2008). Its presence in the southwestern corner Tanzania can be expected, where it is likely to be the only subspecies present. Separating *E. s. pulchra* of the Tunduma–Sumbawanga area from *E. s. citriniceps* in the Rungwa Game Reserve and Mahale Mountains regions to the north is a prominent biogeographic barrier comprised of Lake Rukwa and the Karema Gap (Moreau 1943). Meanwhile, *E. s. pulchra* is also well separated from *E. s. occipitalis* of lowland southeastern Tanzania by the high ground of the Rungwe and Njombe regions, and to the south of there, Lake Malawi. Throughout its range, *E. s. pulchra* is also exclusive to miombo woodland habitat, which may further differentiate this taxon from the less habitat-exclusive *E. s. citriniceps*, given that subspecies' presence far to the north of the central–southern Tanzanian miombo zone in Kenya and Uganda.

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An overlooked breeding record of the poorly known Ethiopian endemic Erlanger's Lark *Calandrella blanfordi erlangeri*, with the first formal description of the egg

The subspecies *erlangeri* of Blanford's Lark *Calandrella blanfordi* is endemic to Ethiopia and has previously been considered a distinct taxon. However, due to only slight differences in morphological characteristics, *erlangeri* is currently treated as a subspecies of Blanford's Lark by most taxonomists (White 1960, Ash & Atkins 2009, Collar & del Hoyo 2016, Ryan and Kirwan 2020). While the nominate form *C. b. blanfordi* is native to areas north of Ethiopia and northern Eritrea, *C. b. erlangeri* occurs only within the central highlands of Ethiopia at altitudes from 1940 to 3640 m (Guichard 1950, Mackworth-Praed & Grant 1960, Pätzold 2003, Ash & Atkins 2009, Ryan & Kirwan 2020). Similar forms previously considered races of the Blandford's Lark *eremica* and *daaroodensis* are now treated with the Rufous-capped Lark *C. eremica* forming a closely related species confined to the Southern regions of Yemen and Saudi Arabia (Collar & del Hoyo 2016, Stervander *et al.* 2016).

Overall, very little is known about the natural history and breeding biology of *C. b. blanfordi* and *C. b. erlangeri* (Keith *et al.* 1992, Pätzold 2003, Ryan & Kirwan 2020). The breeding season lasts from March to June; however, a single nest has also been recorded in October (Smith 1951; reference here is to the northern population of *blanfordi*, sometimes treated as a separate subspecies *asmaraensis*). First egg-dates ($n = 11$) recorded for the species indicate opportunistic breeding year-round, except during the prolonged rainy season between July and September (Ash & Atkins 2009). The nest is reported to be of scanty construction, built entirely of dry grass or occasionally lacking nesting material at all (Smith 1951). Only a few clutches have been reported to date for either subspecies with clutches ranging from two to five eggs in nests of *blanfordi* (Ash & Atkins 2009, Smith 1951), though with eggs undescribed for both forms (Pätzold 2003, Ryan & Kirwan 2020) and details of clutch size not recorded for *erlangeri* (Ryan & Kirwan 2020). In this note, we provide the first formal description of the egg of *C. b. erlangeri* based on a single preserved clutch held at the Field Museum (FMNH Catalogue Number 2883). We also add to the literature details of nesting seasonality and clutch size, from this presumably overlooked breeding record.

The record concerns a single clutch of *C. b. erlangeri* eggs preserved in the Field Museum of Natural History, Chicago, under the label name *Tephrocorys cinerea erlangeri* (*erlangeri* was historically considered conspecific with the Rufous-capped Lark). The clutch, containing two eggs (FMNH Catalogue Number 2883), was collected by A. M. Bailey on the 26 October 1926 around Addis Ababa. No further details about the exact collection locality, notes on nest characteristics or parental behaviour are given in the label description.

The eggs from the above-mentioned clutch are ovate to elongated-ovate, with a cream-white to dull white base colour, evenly covered with different sized spots of light-brown or dark-brown colour, with a higher density towards the larger egg pole (Fig. 1). Occasionally the spots accumulate to form small clusters or blotches, in particular around the larger egg pole. This colour and patterning is consistent with eggs of other members of the genus (e.g., Greater Short-toed Lark *Calandrella brachydactyla)*. The linear measurements (mm) for the two eggs are 19.38 × 14.85 and

19.42 × 14.57, respectively (K. Kueffner pers. comm.). No further information is given in the label description.

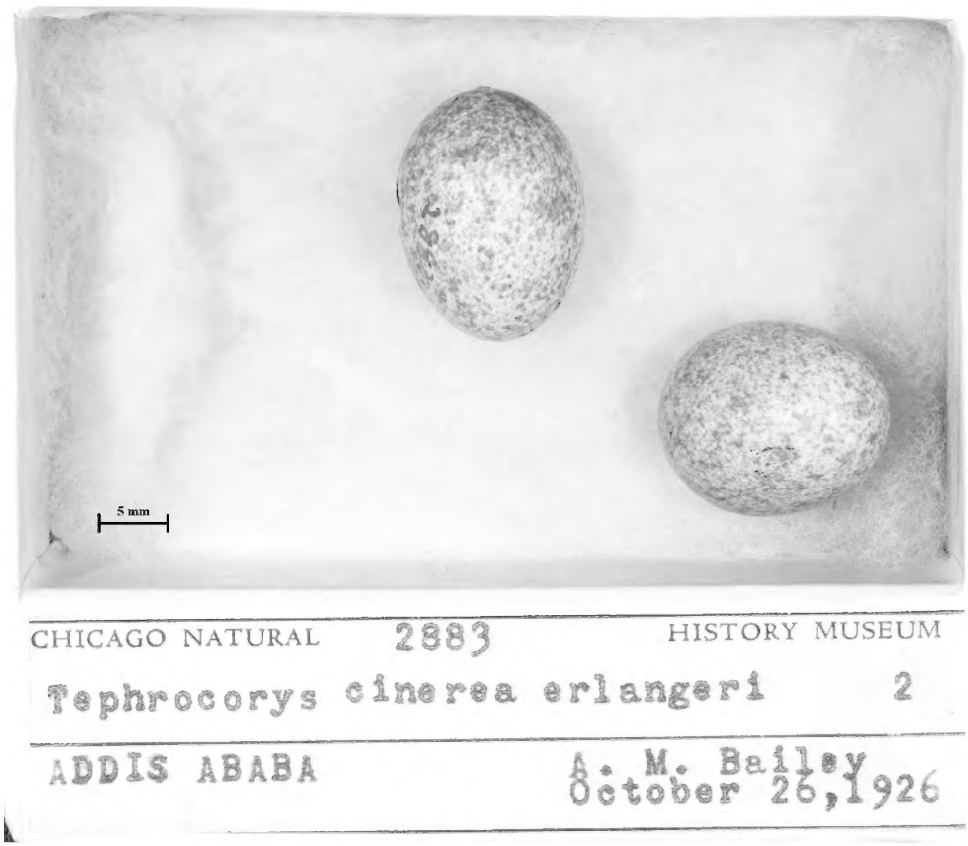

Figure 1. Preserved clutch of *C. b. erlangeri* eggs in the Field Museum of Natural History (Catalogue Number 2883), collected by A.M. Bailey in October 1926 (photo: Kayleigh Kueffner).

Although our note adds a small new detail to our knowledge of *C. b. erlangeri*, much still remains to be discovered about the ecology and life history of the little-known Blanford's Lark

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